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AND MAINTENANCE OF WAY

Vol. IV SEPTEMBER, 1908 No. 9

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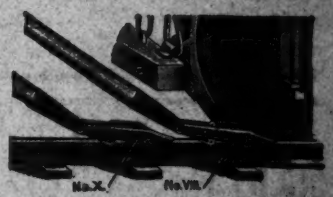

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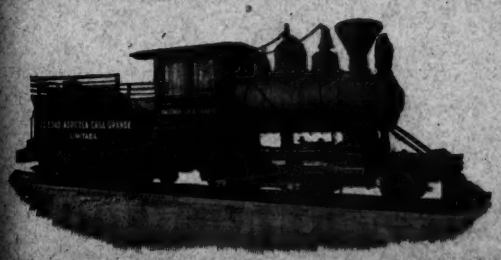

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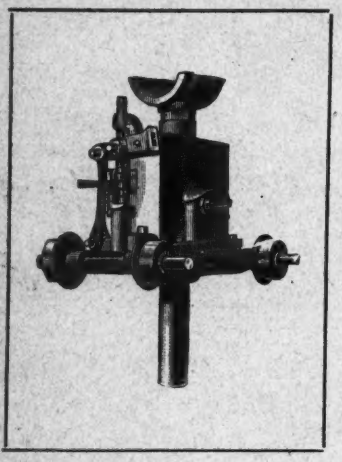

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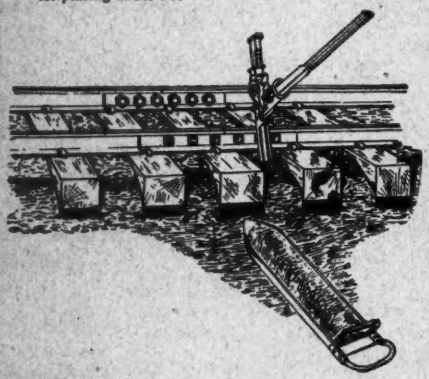
FIG. 1—Showing ballast removed from end of ties to be raised, track jacked up and device in position to receive ballast for placing under tie.



We will guarantee that every particle of ballast will remain under tie and that machine will work in any kind of ballast.

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FIG. 2—Showing pan removed, ballast under tie, and cleaner ready to be withdrawn.

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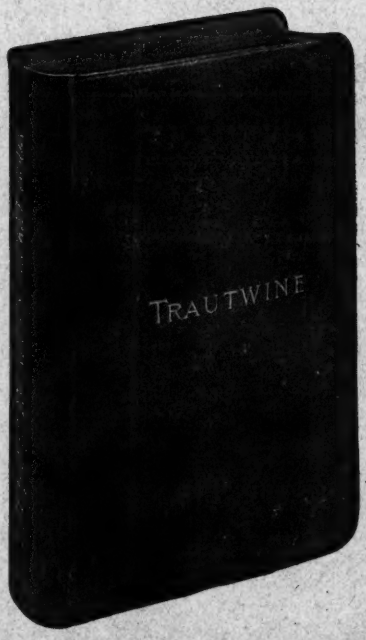

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and Maintenance of Way

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OFFICE OF PUBLICATION: Security Building, Cor. Madison St. and Fifth Ave., CHICAGO Telephone Main 3185

Entered as Second-Class Matter April 13. 1905, at the Post Office at Chicago, Illinois, Under Act of March 3, 1879.

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¶ There is a steady improvement of trade conditions all along the line. Iron, the price of which is the barometer of trade, is showing more activity and manufacturers are stiffening up and asking higher prices. Not only that, but one big concern, whose product is largely used by implement makers, shows a gain in the amount required on Sept. 1st this year over last year.

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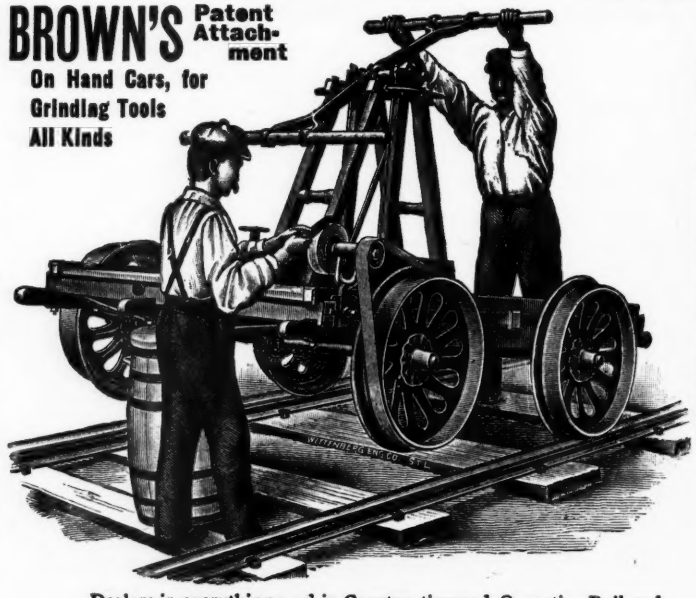

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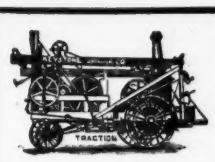

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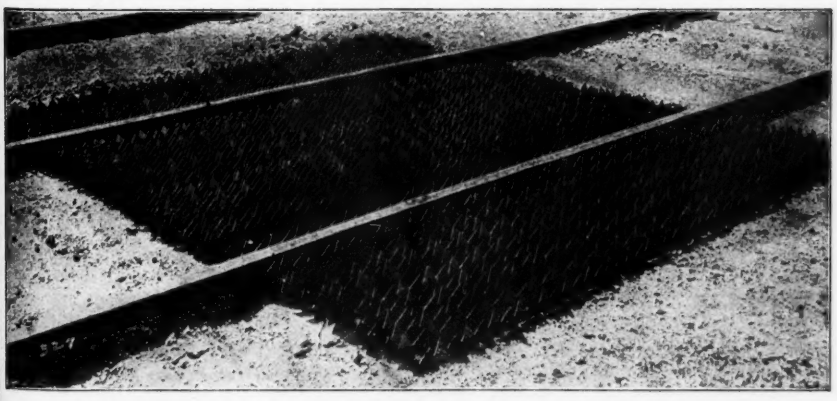

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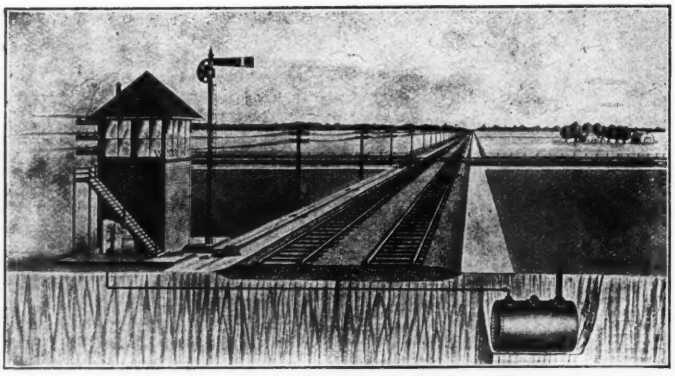

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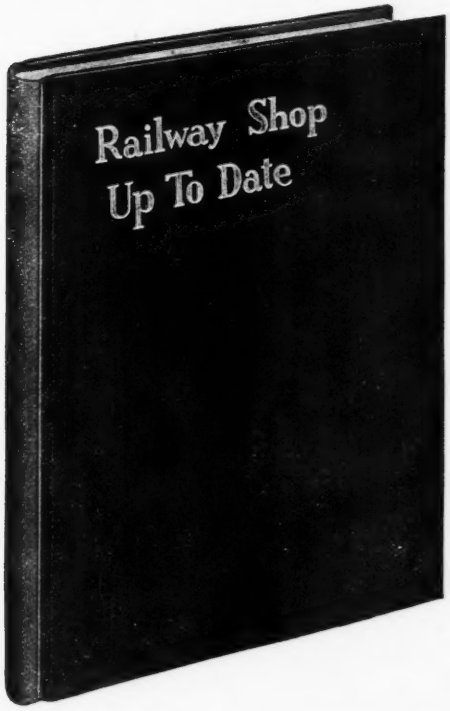

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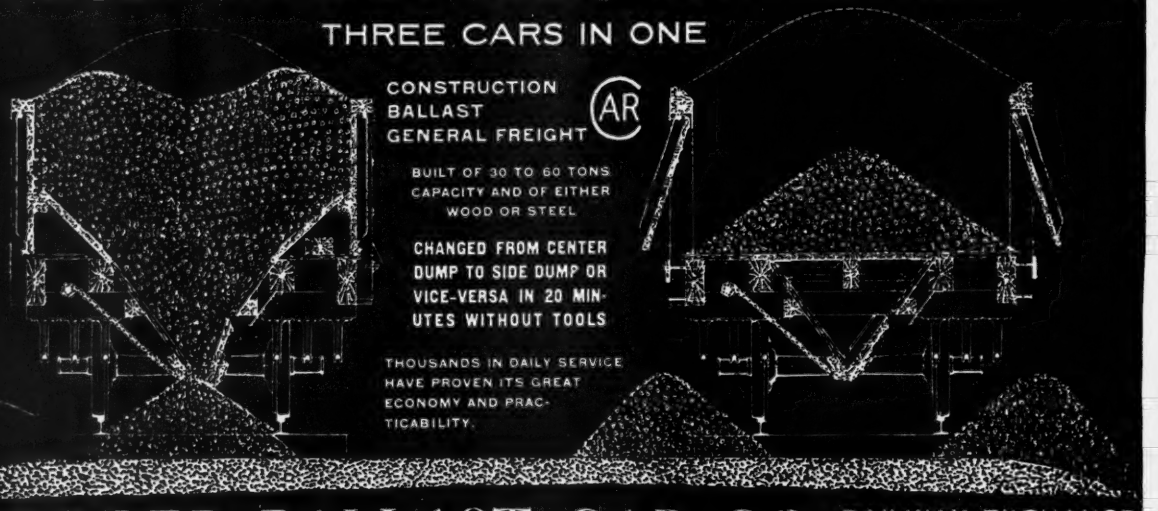
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C. C. ZIMMERMAN, Secretary
WARREN EDWARDS, Vice-President
NORMAN F. REHM, Editor

Office of Publication: Security Building
Corner Madison St. and Fifth Ave.
CHICAGO
Telephone, Main 3185.

A Monthly Railway Journal

Devoted to the interests of railway engineering, maintenance of way, bridges and buildings.

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Papers should reach subscribers by the tenth of the month at the latest. Kindly notify us at once of any delay or failure to receive any issue and another copy will be very gladly sent.

Entered as Second-Class Matter April 13, 1905, at the Post Office at Chicago, Illinois, Under the Act of Congress of March 3, 1879.

Vol. IV. Chicago, September, 1908 No. 9

CONTENTS

An Important Book 177
Shop Extension 177
Improved Sand Delivery Facilities..... 178
Coming Discussions 178
Diagonal Locomotive Erecting Pits 178
Kirk Yard, Gary, Indiana, C., L. S. & E. Ry..... 179
Investigations of Structural Materials 181
Safety Appliances 184
Historical Notes on Locomotive Water Supply... 184
Tramway Rail Joints 186
New Forms of Distant and Home Signals in Germany 188
Egmore Station, Madras, South Indian Railway.. 191
The Cause of Increased Lumber Cut..... 192
Rebuilding of the Quebec Bridge 192
Jury on Track Construction 192
New Zealand Hardwoods 193
Preservative Treatment of Loblolly Pine Cross-Arms 193
Prices on Track Material, F. O. B. Chicago..... 194
Personal Mention 195
Trade Notes 196
Technical Publications 196

An Important Book

ONE of the most important volumes on the construction, maintenance, operation and location of railroads is the ninth volume of the proceedings of the American Railway Engineering and Maintenance of Way Association. The reports and discussions of the 1908 convention should be in the possession of all railroad engineers because they contain some of the most valuable data on present day questions.

The association recommendations, reports and discussions are necessary to the thorough understanding of recent progress in railroad work. They are referred to constantly for information on railway engineering questions. Railroad officials, who are not members of the association and who do not have the opportunity of hearing the discussions at the convention, would profit by having a copy of this reference book.

Shop Extension

THE remarkable growth of traffic on the railroads of this country has made it necessary to improve and enlarge repair shop facilities for both locomotives and cars. Naturally the extension of repair shops should be in proportion to the demands of traffic and it is manifestly good management to provide repair facilities when the conditions demand them.

There are two methods of taking care of an increasing volume of repairs. First, by building new shops, or second, by increasing the efficiency and output of existing shops by the introduction of improved facilities and methods. The first plan naturally suggests itself as being the more logical. Enlarged facilities are generally considered to mean increased output. Since it would be an admission of bad management to concede that existing shops are not working up to their maximum output, it has generally followed that old shops have been enlarged or new shops built to meet the conditions arising during the last few years.

An investigation of conditions, however, shows that in some cases, shop extension and new construction have not been warranted. New shops are expensive and represent an investment that does not possess any direct earning capacity. If the same results can be obtained from existing shops with a smaller expenditure of money than it would cost to construct new shops, it must be admitted that the amount expended on new construction would be a dead loss.

The efficiency of existing shops of a road should be accurately determined before new shops are built. When the efficiency is low on account of poor management and lack of facilities, the output can be increased to the maximum by adopting up-to-date methods. In many cases the increase in output resulting from a change in operation will be ample to take care of the increased volume of repairs and at a much more economical rate than a new and expensive plant. Unless a modern shop is constantly operated at its maximum, the cost per unit of work done is high and the

economical value of the plant is more than offset by the high surcharge cost of production, due to an expensive plant and machinery. This is sometimes lost sight of and not properly charged up to operating costs, but the fact remains that many of the older shops, well managed and equipped with modern appliances, have not only responded to the demands of increased output but have also shown a superior economy in the cost of production over the larger and newer plants. It would seem that the status of the existing shops in regard to a possible increase in output should be carefully determined before the construction of new shops is decided upon.

Improved Sand Delivering Facilities

AN estimate of the average number of tons of sand used by each locomotive of a railroad system or given division per year, taken into consideration with the number of locomotives handled at each of the principal terminals, will indicate to some extent the amount of sand handled for locomotive use. Delivering dry sand to the locomotives after it has been received at the terminal represents labor, in addition to the time consumed in the movement of locomotives to take sand. There are a number of systems in operation for receiving, drying and delivering sand and the point of delivery to locomotives is generally located in the line of movement which an engine follows when taking coal and water. Usually, however, an additional movement is required and each movement consumes time.

An innovation in the method of delivering sand to locomotives has been introduced at the Pittsburg, Kan., terminal of the Kansas City Southern Railway. Instead of the common system whereby sand is taken from a bin elevated immediately above the drying room, it is taken from elevated tanks situated at the cinder pits, where it is delivered through pipe lines. The sand tanks and penstocks are so situated that a locomotive can take both sand and water at the same time that fires are being knocked and without additional movement of the locomotive. The details of this system were illustrated and described in the April issue.

In view of the requirement for rapid handling of locomotives at terminals, every arrangement of facilities whereby their movement is simplified and hastened, tends toward the increased efficiency of the terminal and a corresponding incease in the working hours of locomotives turned at the terminal.

Coming Discussions

NEXT month the Association of Railway Superintendents of Bridges and Buildings will be held. An outline of the committee reports was given in the previous issue. Besides the new reports, there will be further discussion of last year's reports.

Concrete building construction, the expansion and contraction of plain and reinforced concrete walls and the effect of sea water on concrete were among the committee reports of last year. The construction of walls was given particular attention, the use of plaster on expanded metal being suggested as cheap and satisfactory for shop buildings. Concerning expansion and contraction of concrete walls the committee decided that no set rule could be given for the amount to be allowed.

The progress report on wooden and asbestos smoke jacks was supplemented with illustrated descriptions of jacks now in use. The committee did not recommend a definite form or the best material for engine house jacks but suggested careful investigation of wooden jacks for the purpose of eliminating faults either in style or construction.

The committee report on locks and fastenings for doors of shop buildings referred to a number of designs which were illustrated and described. Simplicity was recommended in such contrivances because they are then easier and cheaper to maintain and often more effective.

The question of protecting steel railroad bridges against the action of brine from refrigerator cars constituted another report. That brine should be retained in cars and drawn off at points where no injury to structure would result and that no paint has been found which is effective in protecting metal against the action of brine are features of the problem upon which the committee was agreed.

The above-mentioned subjects will be brought up at the coming convention for discussion.

Diagonal Locomotive Erecting Pits

THE criticism has been offered that a locomotive erecting floor arranged as in the Silvis shop of the Chicago, Rock Island & Pacific Railway, does not require a pit for each locomotive undergoing repairs.

In this shop the working pits are neither transverse nor longitudinal, but are diagonal. The principle on which the pits are laid out provides for the angle of location to be determined by an average length locomotive suspended from two cranes about to approach each other. The pits are arranged in two rows and midway between is a track extending the full length of the shop. At each end of the shop and beyond the area occupied by the diagonal pits, this track includes a pit 132 ft. long. At the end of the shop at which locomotives enter, are two additional pits of the same length, parallel with the longitudinal track and spaced 24 ft. between centers, these three pits affording sufficient space for stripping and preliminary work. At the other end of the shop are two longitudinal pits of the same length similarly aranged.

Locomotives entering the shop are unwheeled and stripped on the longitudinal pits. They are then transferred by the cranes to the diagonal pits where repairs are made and are finally rewheeled on the longi-

tudinal pits at the end of the shop opposite to that at which they entered.

The criticism that pits are unnecessary under the diagonal working stalls seems to originate in a belief that as the engines are unwheeled and wheeled over pits, the remaining work of repair can be done conveniently on an erecting floor with no depression in the space beneath the dismantled locomotive. Advocates of such a method of procedure would then seem to commend a mere allotment of space for each engine after it had been unwheeled.

There are a number of reasons why it would be impractical to attempt locomotive repairs without a deep working space beneath the locomotive and beyond the provision for economy in the first cost of construction there is no apparent reason for dispensing with the pits. The pits are so disposed as to offer no impediment to foot or truck traffic about the floor; distribution of material is equally convenient either longitudinally or transversely. With no depressed working space beneath each locomotive, it would be necessary to block the locomotive at a greater height above the floor than is customary. Blocking at such height as to facilitate work beneath a locomotive, would require men to work on scaffolds while doing jobs which could otherwise be done from the floor. Such additional blocking and scaffolding naturally offers greater impediment to movement about the engine and is inconvenient at best. More or less boiler washing is necessary during the time that a locomotive is in the back shop and the absence of a pit by which to dispose of the water would cause considerable inconvenience and delay. Water used in testing boilers must be disposed of also. The nature of the work, both boiler washing and general repair, requires such disposition that progress shall not be interrupted and an attempt to wash boilers on the limited longitudinal pit space at one end of the shop would cause delay and congestion.

Kirk Yard, Gary, Indiana

C., L. S. & E. Ry.

THE Chicago, Lake Shore & Eastern Railway has terminal shops under construction at Gary, Ind. The new shops are located west of and adjoining the new plant of the Indiana Steel Company.

The layout of the terminal is shown in Fig. 1. The roundhouse is located at the east end and arranged so that an extension may easily be made. Adjoining the roundhouse is a 100x125-ft. machine shop which has a passage way between the roundhouse and shop that is continuous with the structure.

The material yards, woodworking shop and car repair shop are located to the north of the tracks leading to the roundhouse. All buildings are placed so as to limit to the smallest amount the switching of cars and engines and the transfer of materials. In this layout a transfer table is unnecessary.

ROUNDHOUSE.

There are twenty tracks radiating from the 70-ft. turntable, the center of turntable being about 150 ft. from the inner wall of roundhouse. The depth of roundhouse is 85 ft., the pit being 21 ft. from the outer wall and 10 ft. from the inner wall. The floor of the

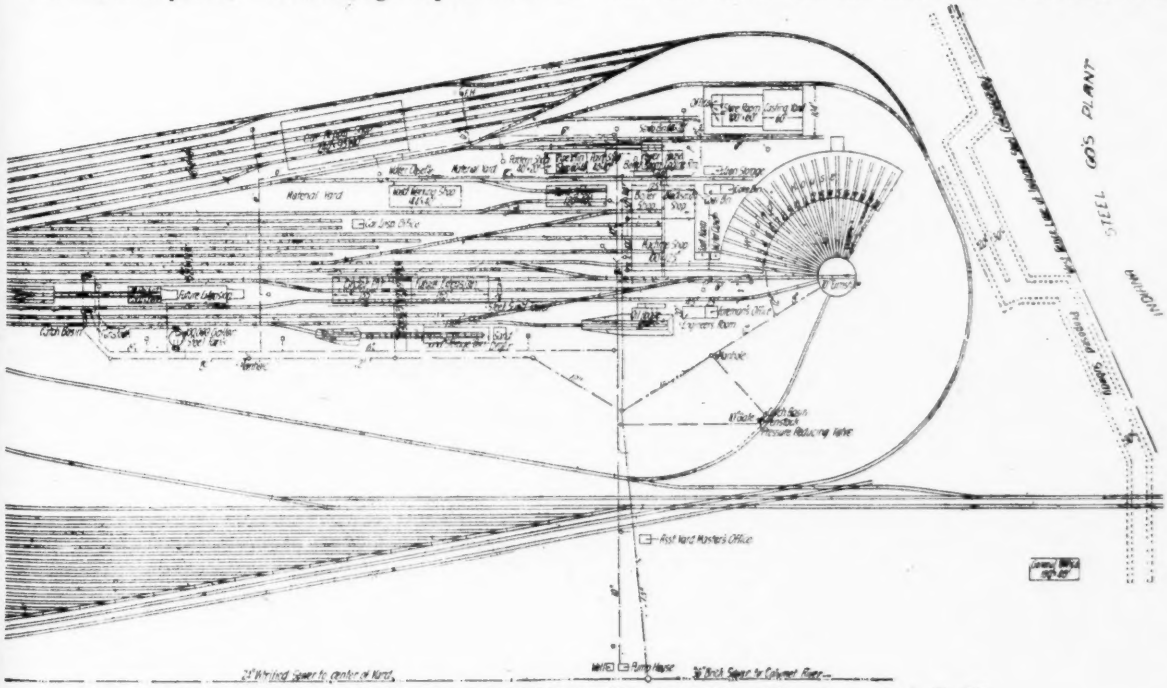

FIG. 1—GENERAL LAYOUT OF TERMINAL SHOPS AT GARY, IND.—C., L. S. & E. RY

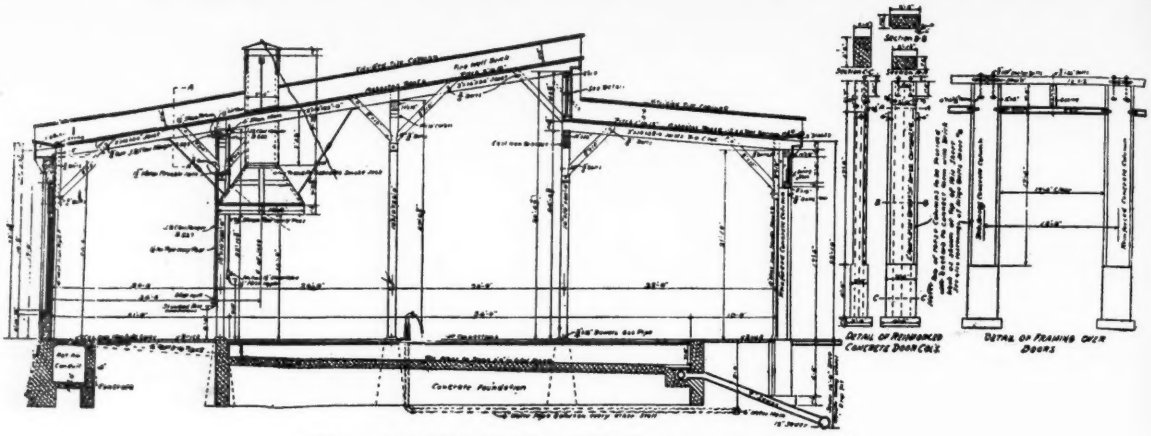

FIG. 2—SECTION OF ROUNDHOUSE—C., L. S. & E. RY.

roundhouse is of brick and the pit floor is of concrete.

The roof of the roundhouse is supported by 10x14-in. beams on 10x10-in. columns. The joists are 3x14 ins. and are placed 4 ft. 1⅜ ins. on centers. The joists carry 2x6-in. M. & D. roof boards which are covered with asbestos roofing.

The door columns are reinforced concrete. A detail drawing of the columns is shown in Fig. 2 which also gives a cross-section of the roundhouse.

There is a 1½-in. air pipe and a 1½-in. steam pipe at each post. A 4½-in. water pipe with a 2½-in. hose connection is placed between every other stall. The hot air conduit is shown at the outer end of the building.

SMOKE JACK.

The smoke jack, shown in Fig. 3, is made of Transite asbestos board, manufactured by the H. W. Johns-Manville Company. The distance from rail to jack is 14 ft. 2 ins. and the height of jack is 19 ft. 6 ins. The hood measures 2x14 ft. and the cross-section of the stack is 1 ft. 6 ins. by 3 ft. 4 ins. The jack is made of ⅜-in. Transite plate and is held by four ⅜-in. round rods to the joists.

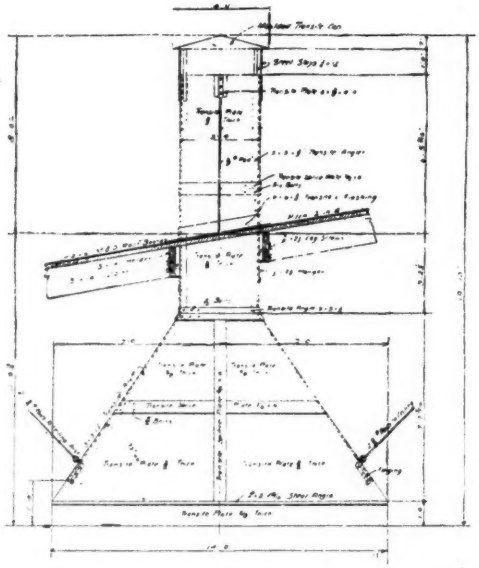

FIG. 3—SMOKE JACK—C., L. S. & E. RY.

MACHINE SHOP.

A floor plan of the machine shop is shown in Fig. 4. The building is 150x125 ft., but the north end is used for the boiler and blacksmith shops. There are four 40-ft. pits in the machine shop and one in the boiler shop. The track at the south end of the building extends through a passage way into the roundhouse.

The floor of the machine shop is made of 1⅛x3¼-in. face matched maple laid diagonally on 2-in. hemlock plank, dressed on one side and laid longitudinally or transversely. Sleepers, 3x4 ins., are placed 4 ft. apart. Below the 2-in. plank is 4 ins. of tar concrete (distilled coal tar and gravel). The floor in boiler and blacksmith shops is made of cinders well tamped.

SAND TOWER.

The sand tower, shown in Fig. 5, is located east of the cinder pit between the tracks leading to the turntable. The bin is 5 ft. wide, 20 ft. long and 7½ ft. high, and the bottom of bin is 23 ft. 8 ins. above the rails. The bin is supported on four steel columns bolted to concrete piers. The bracing consists of angle bars placed as shown in the drawing.

A detail drawing of the sand valve is shown to the right of the sand tower in Fig. 5. A spout is located on each side to supply locomotives on either side.

CINDER PIT WITH GANTRY CRANE.

The cinder pit with gantry crane is shown in Fig. 6. The pit is 156 ft. in length and provision is made for a future extension of 155 ft. Three tracks pass over the pit, two being used by locomotives and the center one being used for cinder cars. The crane, extending over the three tracks, is 55 ft. center to center of rails and is provided with a 54 cu. ft. automatic bucket to load cinders into the cars on the center track.

The cinder pit has a sand bottom which is 10 ft. below base of rails. The distance between centers of the outer tracks is 38 ft. The center piers, side and end walls are built of reinforced concrete.

OIL HOUSE.

The oil house, shown in Fig. 7, is 24 ft. wide and 50 ft. long. It is located south of the machine shop at the side of the tracks leading to the roundhouse turntable. On the south there is an elevated track for tank

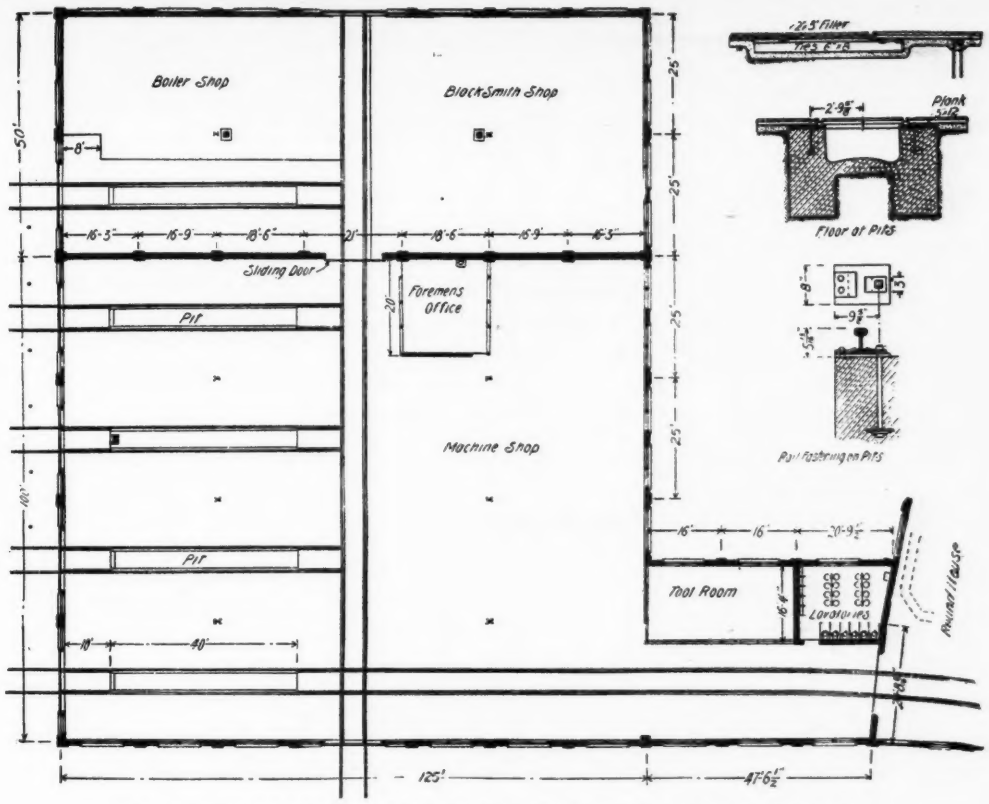

FIG. 4—PLAN OF MACHINE SHOP AND DETAIL OF PITS—C., L. S. & E. RY.

cars and the oil is to flow into the steel tanks in the basement of the oil house by gravity. There are two steel tanks, 7 ft. in diameter and 30 ft. long. Each of these tanks has three compartments. One tank holds car oil, signal oil and valve oil, and the other holds engine oil, kerosene and fuel oil. The relative sizes of the compartments are shown in the drawing.

The walls of the building are of brick. The interior columns consist of steel I-beams upon which is carried a 12-in., 40-lb. I beam. The floor is of concrete, reinforced with 8-in., 18-lb. I beams with ¾-in tie rods. A steel truss carries a reinforced cement roof upon which is laid roofing tile.

Investigations of Structural Materials

IN an address by Joseph A. Holmes fuel and structural materials investigations by the Technologic Branch of the U. S. Geological Survey are outlined. In the following extracts from the address, structural materials investigations are discussed:

WORK IN PROGRESS.

These investigations are being conducted with a view to determining the nature and extent of the materials belonging to or available for use in the building and construction work of the government, and how these materials may be used most efficiently.

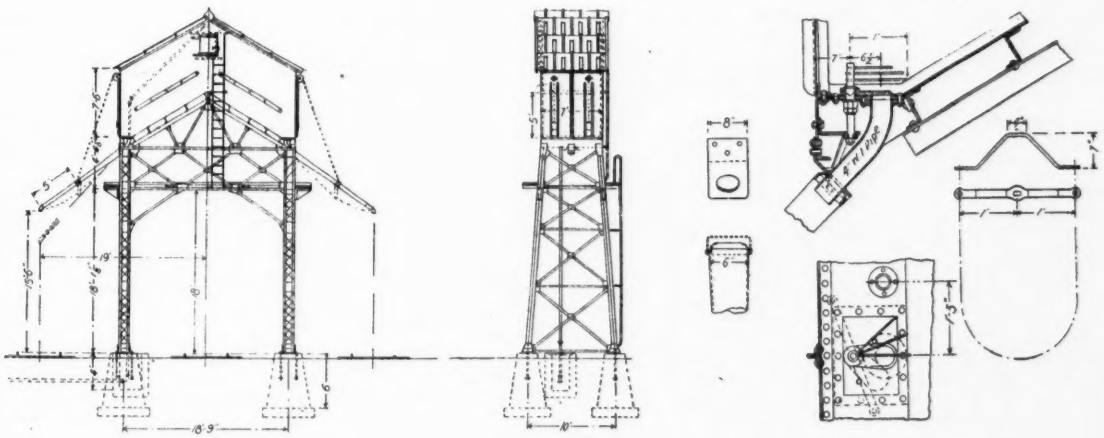

FIG. 5—SAND TOWER AND DETAILS OF SAND VALVE— C., L. S. & E. RY.

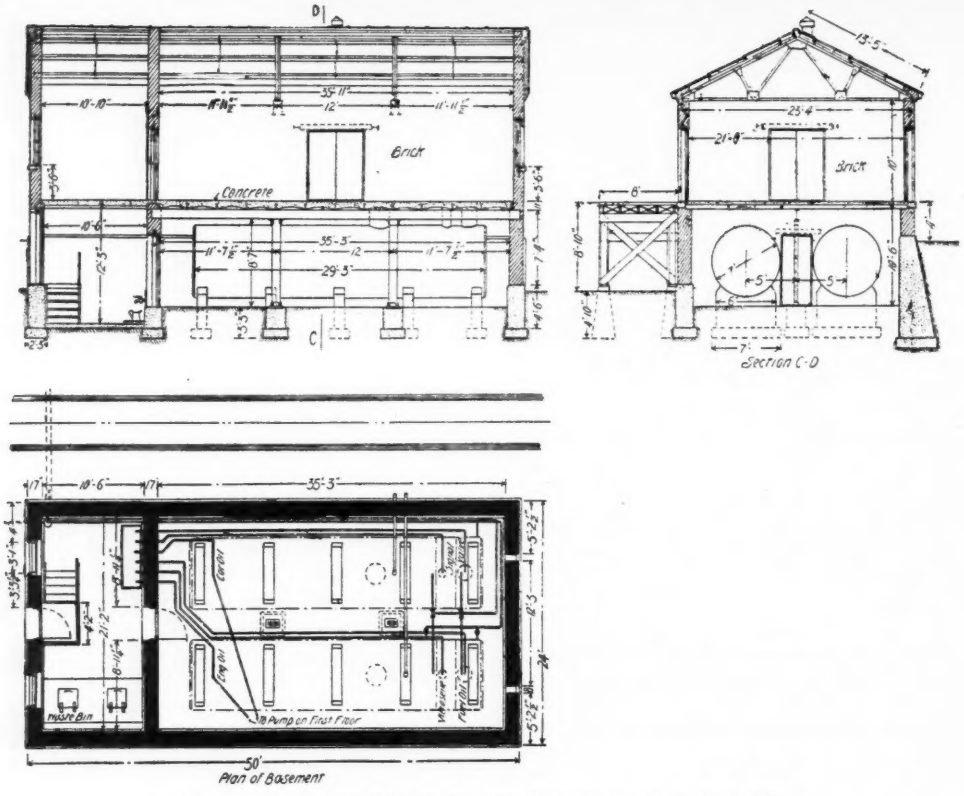

FIG. 7—PLAN AND SECTIONS OF OIL HOUSE—C., L. S. & E. RY.

It may not be amiss to call attention again to the fact that no testing or investigations are conducted for private parties. At the same time, it is believed that both the ordinary tests and the investigations, though conducted to meet the needs of the government, cannot fail to be of great value to the engineering profession and the general public. The building and engineering construction work of the federal government now aggregates about $40,000,000 annually; and this work is being done under so many different conditions and requires so great a variety of materials, that the problems which the government needs to have solved for its own purposes can hardly fail to be broad enough to cover a large share of the needs of the engineering profession, for state and municipal governments, and for the general public.

These investigations include inquiries into:

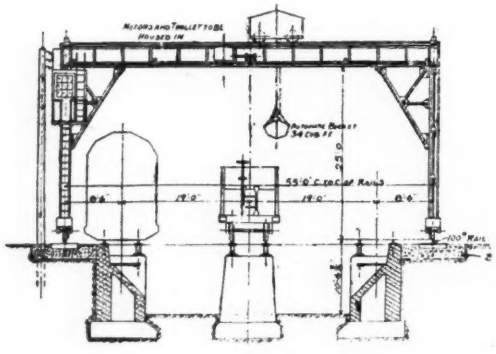

FIG. 6—CINDER PIT WITH GANTRY CRANE—C., L. S. & E. RY.

A—The nature, extent and distribution of materials such as are needed for use by the government.

B—How they can be used most efficiently under different conditions.

C—Their fire-resisting qualities and strength at different temperatures.

D—How the steel supports in building construction can best be protected from fire by inclosing them with thicknesses of different fire-resisting materials, and the strength of these supports at different high temperatures.

E—The value of protective coatings as preventive of deterioration of structural materials by destructive agencies.

F—The extent to which concrete made from cement and local materials can be most safely and efficiently used for different purposes under different conditions.

G—The materials suitable for the manufacture of cement on the public lands or elsewhere in the country where the government has planned extensive building or engineering construction work and where no cement-plants now xist.

H—The best methods for mixing and utilizing the various constituent materials locally available for use in government construction.

I—The kinds and forms of reinforcement for concrete and the best methods of applying such reinforcements to secure the greatest strength in compression, tension, shear, etc., in reinforced concrete beams, columns, floor-slabs, etc.

J—The influence of acids, oils, salts and other for-

eign materials, long-continued strain, or electric currents on the permanence of the steel in reinforced concrete.

K—An investigation of clays and clay-products needed in government work, and the most efficient methods of testing clays and clay-products.

L—An investigation into the building-stones available near the building centers in the various parts of the country where the government is planning extensive building or construction work.

M—The establishment of working-stresses for various structural materials needed by the government in its buildings.

In addition to the large extent and variety of building and construction work of the government, the amounts expended by the several municipalities and the people of the country in building and construction work now exceed $1,000,000,000 per annum, of which more than one-half is represented in structural materials.

The scope of the structural materials investigations necessarily includes examination of the various constituent materials in the field, the collection and shipping of samples to the testing-laboratories, the assembling of these samples into various structural forms, and the testing of these forms to determine the best method of mixing and seasoning such materials.

The cement used in these investigations was prepared by thoroughly mixing half a dozen Portland cements of well-established brands. All other constituent materials used were collected in the field by trained experts, with due regard to the nature and extent of the available supplies of such materials. Each series of tests is therefore not only a contribution to our knowledge of the properties and behavior of concrete, but also a contribution to our knowledge concerning the structural materials resources of the country.

While the purpose of these investigations is to meet the government's own needs as the greatest consumer of structural materials, incidentally the results will be generally useful to the various states and municipalities, and to the people of the whole country. Finally, these investigations are so planned as to make use of and to correlate all similar work by others, either in state testing-laboratories, in the testing-laboratories of the various universities, and through the agencies of the engineering societies and their joint committees, etc.; all this work with a view to avoiding all unnecessary duplication, and securing thereby the wisest expenditure of all funds available for such investigations from whatever source.

The work in the past has been confined largely to the constituent materials of concrete and the concrete itself, the funds available being too limited to admit of a more rapid extension of this work to other structural materials, and this being the material concerning which there was the greatest demand for information by the various branches of the government service. During the next fiscal year, however, it is proposed to take up on a larger scale the additional subjects heretofore neglected, in accordance with the above brief statement.

In the plans for all these tests and investigations due consideration is given to the good work done at the testing-station of the Watertown Arsenal and in the laboratories of educational institutions, with a view to avoiding duplication.

Some Results of Tests.—Until recently the results obtained from the investigations of structural materials by the Geological Survey have seemed to be slow in forthcoming. The obvious reason therefor is the fact that elaborate and expensive testing-apparatus had to be designed, purchased, and installed. After nearly a year of preparation there was further delay in securing results, due to the necessity of giving the test-pieces of cement, mortar or concrete sufficient time in which to season for the requisite 7-day, 28-day, 3, 6, 12, 18 and 24-month testing-periods. Finally, the time-element has been felt in the digestion of the results of the tests, due to the involved computations necessary in order that the vast number of tests made might be intelligently discussed. Happily, these inaugurating periods of preparation have in a measure passed and the results are now forthcoming rapidly.

There have been made at the structural materials testing-laboratory more than 39,300 separate test-pieces, upon which nearly 53,000 tests have been made, and in connection with the study of which over 10,400 chemical determinations have been made. Of these tests nearly 27,800 have been of the constituent materials of concretes, including tensile-tests of cement-briquettes, compression-tests of cylinders and cubes, and transverse-tests of various specimens, etc.

There have been made nearly 1,100 beams of concrete or reinforced concrete, each 13 ft. long and 8 by 11 in. in cross-section. There have been made a total of over 2,500 tests in connection with the investigation of the behavior of these beams. Tests have been made on 870 of these beams, or probably more than double the entire number that has been made in other laboratories in this country during a period of more than 15 years.

In the section of building-blocks, 2,200 blocks have been tested. Also, more than 900 pieces of concrete have been tested for permeability and shear. Physical tests have been made to the number of nearly 13,000; tests of steel for reinforcement to the number of 3,500; and tests to determine fire-resisting qualities of various building materials have been made on 30 special panels.

While the time since the inauguration of this work has been entirely too short to warrant a serious questioning as to resulting money-returns to the government, yet a few general beneficial results are men-

tioned below, though a number of specific items that might be mentioned are omitted for lack of space.

Reconnaissance survey has been made of constituent materials near several building centers and locations for engineering construction, at requests from the Supervising Architect, Corps of Engineers, U. S. A., U. S. Reclamation Service, and other branches of the government service.

Tests of these constituent materials, including sand, gravel, broken stone, and gravel and stone screenings, assembled into mortars and concretes, indicate clearly where the government may find these most convenient and economically available for construction of public buildings and engineering works.

Special tests of more than 1,000 plain and reinforced concrete beams, floor-slabs, columns, etc., are demonstrating the proper method of proportioning the constituent materials and of placing the reinforcing and the amount thereof to secure for each group of materials locally available the most efficient and economic results for the building and engineering construction work of the government.

These tests indicate the possibility of reducing the amount of materials necessary, and of thereby producing economies of upwards of 10 per cent in design of public buildings and structures using wholly or in part reinforced concrete construction. It is well known that through present lack of knowledge of behavior of concrete and reinforced concrete, high factors of safety, involving the use of excessive quantities of materials, are now necessary in designing structures of these materials.

As a single illustration of how these investigations, conducted to meet the needs of the general government, may incidentally be of service to the engineering profession or to state or municipal governments, it may be mentioned that the investigations of the sands and gravels in the vicinity of Louisville, Ky., for the use of the Supervising Architect of the Treasury Department and the Corps of Engineers of the Army, are said by the engineers in charge of the new sewer-system of that city to have saved the city in that construction work not less than $100,000.

Safety Appliances

Decisions handed down at St. Louis by the federal court of appeals in cases against the Santa Fe and the Denver & Rio Grande roads, sustain the position of the government against the railroads in the matter of the safety appliance law. Heretofore the common law rules of "reasonable care" have governed, but these have been swept aside and abrogated in these latest cases, by the following new rule: The safety appliance law of Congress imposes upon a railway company in the situations in which it is applicable an absolute duty to maintain the prescribed coupling appliances in operative condition, and is not satisfied by reasonable care to that end.

Historical Notes on Locomotive Water Supply

By C. H. Rice

IN the early days of railroading the question of water supply for locomotives was not nearly so important as at the present time. The locomotive tanks held but a few barrels of water and the number of locomotives was very small. In 1840 the New York & Harlem Railroad had but seven locomotives, and until 1844 the Auburn & Rochester Railroad had but ten. Regular freight service between Rochester and Auburn was started in 1846 with one train a week each way, which amply provided for the business.

Mr. William Perry, now living at Rochester, hale and hearty in spite of his 80-odd years, began railroading as a locomotive engineer in 1840, and retired from railroad service in 1880. He was more or less familiar with the old New York Central group of roads, extending from Albany to Buffalo, the first link of which—the Mohawk & Hudson River Railroad—opened in 1831, and the last link—the Attica & Buffalo Railroad—opened in 1842. He was especially familiar with the Auburn & Rochester Railroad, opened in 1841, but all the roads were very similar in their equipment for supplying water to locomotives. Tanks were usually round (there were probably few rectangular ones) and quite small, probably about 12 ft. in diameter by 8 ft. in height, and as traffic increased a second, or even at important points a third and fourth, tank was added. These old original tanks were gradually replaced by larger tanks, but, according to present-day practice, still quite small, having a capacity at the most of 15,000 gallons. It was quite usual to house in the tank, or tanks, and a stove on the ground floor was used to prevent freezing in winter.

Frost-proof tanks made their appearance about 1872, among the first—if not the first—being one at Front street, Schenectady. Tanks now in use are mostly quite modern, the great majority having been built since 1900, and are of 50,000 gallons capacity. The oldest tanks in use are at Alder Creek, between Utica and Carthage, built in 1874, two tanks of 6200 gallons each.

In early days the water supply at terminals was often quite inconvenient, according to present-day standards. The New York & Harlem Railroad built shops and an engine house at Thirty-second street, New York, in 1846, prior to which their locomotives had run to Twenty-sixth street. As to the water supply at this original terminal, little or nothing is known, but at the Thirty-second street engine house and shops the water was stored in a round tank in the shop on the west side of the street, and the locomotives were housed on the east side of street. Locomotives had to enter the shop to take water through a leather hose. After a lengthy dispute with the city, the use of steam locomotives south of Forty-second street was discontinued about 1860.

The engine house, which was built a few hundred feet north of Forty-second street, near Madison avenue, was

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*From Bulletin No. 100 of the American Railway Engineering and Maintenance of Way Association.

equipped with a 4-in. pipe carried on roof trusses and extended around the house so as to supply each engine track. Over each tender there was a valve and a short length of leather hose. The water supply was from a large city main in Fourth avenue.

At Albany, water was obtained by backing off the turntable onto track in the roundhouse, alongside of which a 3-in. pipe came out of the ground. It was necessary to open a stop-cock, and water was admitted through leather hose. The supply was by gravity.

At the Front street roundhouse, Schenectady, water was pumped through pump logs from the Mohawk River into a brick tank or standpipe built up through the house, with a capacity of about 2,000 gallons. A 3-in. cast-iron pipe, connected with this tank, stood at the entrance to the house, and all engines when they went onto the turntable for turning took water through a leather hose connecting to this 3-in. pipe.

The connection from tank to tender was originally in most cases (possibly all) a copper-riveted leather hose. By 1850 metal spouts had made their appearance, and about 1853 all tanks on the Syracuse & Auburn road were equipped with copper spouts. So far as can be ascertained, wooden spouts were never used. The use of leather hose for spouts lingered in some places to quite a late date—at the New York & Harlem engine house, north of Forty-second street, on the site of the Grand Central yard, until the house was abandoned upon the opening of the Grand Central station in 1871; at Ossining until about 1880. The older parts of the Rome, Watertown & Ogdensburg were originally equipped with leather hose, which were replaced by metal spouts about 1855.

In the very beginning gravity was used for water supply to tanks where it was easily attained, Victor between Rochester and Canandiagua being an example of such early use. The most usual practice, however, was the use of hand-power pumps. The man who worked the pump was in most cases switch tender. As traffic increased, it became necessary for the pumper to give his whole attention to keeping the tank full, and with the gradual use of night trains the employment of two men became necessary. The use of hand power continued in a few cases to quite a late date; at Batavia and Canadiagua its use was discontinued about 1870; it was in use on the New York & Harlem Railroad, at Pleasantville, as late as 1886.

Near Richville, on the Potsdam & Watertown Railroad, opened 1857 (now Rome, Watertown & Ogdensburg), a man hired to work a hand pump, contrived a small homemade overshot wheel to do the work and hired himself to a section foreman as a section hand, thereby getting double pay. This was soon discovered and the ingenious pumper promptly discharged, but his overshot wheel continued in service until about 1882.

Horse power was used for pumping in a few instances. At Cayuga, Coldwater and Batavia such power was used but a short time, and about 1845 it was replaced by either hand power or hot-air engines. At Sanborn, on the Rochester, Lockport & Niagara Falls Railroad, horse power was used until about 1870.

Little definite information is obtainable about the old hand and horse-power pumps. They were probably commercial products of the day, and the successive consolidations of lines has made it impracticable to search old files which would probably give very little information if this were practicable.

Hot-air engines were in use at an early date, possibly before 1845; by 1850 their use was rather common. About 1868 they began to be replaced by steam engines, and they rapidly disappeared from service.

About 1868 quite a number of rotary pumps were installed. Their use continued until 1875. At Fishers, between Rochester and Canandaigua water is now pumped by a water turbine, which has been in use since about 1875.

Hydraulic rams have been used in at least three cases; at Caledonia, between Batavia and Canandaigua, where it was discontinued about 1875, and at Cold Spring and Montrose, between New York and Albany, where they did not prove satisfactory, and were replaced by hand power about 1860.

The use of windmills for pumping has been very limited. One was erected at Spencerport about 1878, and discontinued two years later. Two, supplemented by steam power, are still in use, one at Karner, the other at Chateaugay.

Steam power has been used for pumping almost, if not quite, from the beginning. The tank in the shop built by the New York & Harlem Railroad in 1846, west of Fourth avenue at Thirty-second street, New York, was filled by a steam pump. On the western portion of the road some Knowles pumps, installed in 1868, were used until 1902.

The first electric pump was installed at North White Plains in 1901. It is a Deane, 15,000 gallons per hour, and takes current from the company's generators. It has proved very satisfactory. A second electric pump is now being installed at Horseshoe, on the M. & M. R. R.

The first water column on the New York Central Lines was probably one in the present Grand Central yard, installed about 1860, supplied from city main. There was no means of draining the pipe, and in cold weather fire was frequently built about it to thaw it out. About 1872 the shops at West Albany made some water columns, and one was installed at Schenectady and one at Yosts. These columns were much like those now in use, except for size. In the western part of the state columns from West Albany were first used about 1876. On the Rome, Watertown & Ogdensburg, where very severe winter weather is encountered, a short length of steam hose has been provided at each water column since 1900; steam from a locomotive blown into a column quickly relieves any trouble from frost. At other points on the system a steam jet is introduced into the pit with satisfactory results, and yet others, a large tin lamp, with a deflector to keep water from dripping on the flame, is placed in pit in extreme weather. This latter method has

proved quite effective, and it is usually made the duty of the section foreman to look after the matter.

The first track pan in the United States was built at Montrose, between New York and Albany, and put in service in 1870. It was for the use of the fast Saratoga trains at that time, was supplied with water by a hand pump, and no provision was made against cold weather, its use being discontinued in the winter.

The first track pan on the Mohawk division was at Palatine Bridge, and was installed about 1889. It has since been replaced by one at Yosts.

The first track pan on the Western division was built in 1892, at Churchville.

The use of pump logs was quite usual in the early days, especially on the Rome, Watertown & Ogdensburg, where the last of them was dispensed with in 1900, at Lyons Falls. At Attica and East Bloomfield, on the Western division, pump logs were in use until 1890, when they were replaced with cast-iron pipe.

Tramway Rail Joints

THE modern permanent way in Great Britain has become almost of standard construction. The track is usually formed by laying girder rails directly on a bed of concrete, but there are some exceptions, notably at Sheffield and Hull. At Sheffield several experiments have been, and are being tried with various forms of wooden sleepers laid longitudinally under the rails, to which the rails are anchored down by bolts and plates, and this sleeper forms a good support for the joints. It appears, however, too soon to say whether this method, in addition to forming a cushion for the rail, also results in a satisfactory joint. It would seem that any initial irregularity in the rail ends forming the joint would ultimately result in the well-known knocking, and would produce holes where the wheels jumped forward. At Glasgow, during the last three years, heavy cross timber sleepers have been adopted on all extensions and renewals of track. For the purpose of this paper, however, the ordinary concrete track will be assumed. In most of the principal towns the rail weighs from 90 to 105 lbs. per yard, according to the section.

With the inauguration of steam and electric street railway systems, deficiencies of jointings were quickly apparent, and all the trouble with bonds and fishplates, through pounding, began to be experienced. As it is absolutely essential that a tramway joint when once screwed up should remain tight, it follows that the rail should be so designed as to relieve the bolts as far as possible of any tensional efforts tending to loosen the fishplates. Experience proves that in all cases joints have a tendency to become loose and "spring" through the continual passing over of the cars, and, however slight this springing may be at first, it is rapidly increased by every car which passes over it. Hence, when the joint is badly worn, it

*Extracts from a paper by Alfred H. Gibbings, before the annual congress of the Tramways and Light Railways Association, England.

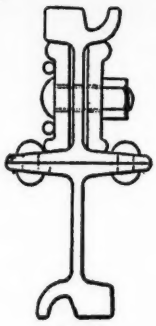


FIG. 1.

FIG. 2.

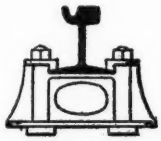


FIG. 3.

THE COOPER, WINBY AND KIRKLAND ANCHOR CHAIRS FOR RAIL JOINTS.

appears that the only remedy is to cut out and renew either the joint or the concrete beneath it, or both. This becomes a very expensive operation, and necessitates removal of setts and paving. It seems to follow, therefore, as a natural deduction from the foregoing remarks that fishplates should not be required to take a vertical thrust. The function of fishplates should be confined to jointing the web, and the vertical thrust should be taken by some other means.

The principal types of rail joints are comprised: Sole plates; (b) welded joints; (c) anchors; (d) combinations; (e) adjustable joints. In order that the latest practical experience might be brought to bear upon this subject, the writer submitted a list of inquiries to several tramway managers, and they very kindly responded to the request for information. Their replies are embodied in the following paragraphs, and they record wide and diverse experiences.

The original and simplest method of taking the vertical thrust at the joint was by means of sole plates and fishplates. Sole plates are now in use at Hull and Darwen. In the case of Hull the rail ends are cut to an angle of 45 deg. in plan, and the rails are laid on continuous creosoted sleepers. At Darwen they are apparently being discarded in favor of other types. In neither case has any account been kept of the cost of renewals.

The principal welds are the "Falk," the "Thermit," and the electric. One or other of these welds is in use in many towns, including Glasgow, Leeds, Southampton, Nottingham, Liverpool, Brighton, Darwen and West Ham. The replies from Brighton and Darwen are both favorable to the welded joint, but it does not appear that welds have been extensively used in those towns. The advantages which are claimed for the welded joint may be summed up in the statement that it should constitute a continuous rail both as regards wear and tear and electrical conductivity. There can be no doubt that when two rail-ends are thus fastened together with a close joint, the result will appear theoretically and practically perfect. As a matter of fact, however, the rail ends in some portion of the rail and rail head always remain severed, and this occurs principally near the running surface or point where the real wear takes place. In other words, the weld is the least effective and satisfactory at the point where it is most required.

The difficulties of making a satisfactory practical weld are many and obvious. The difference in the chemical composition of the two metals in the case of the "Falk" and "Thermit" welds, and the great cost of the electric weld may be cited by way of illustration. All three processes also tend to alter the temper and nature of the rail ends, and so produce a new fault while remedying an old one. The opinion at Glasgow is that the welded joint is the most satisfactory from every point of view, except in the case of renewals; at Leeds and Southampton a similar opinion is expressed. At West Ham no comment is made. It must be noted that in each of these instances the experience with these joints has been only for about three years. At Nottingham the city surveyor puts the life of a welded joint at about three years, as at the end of that time fractures begin to occur and renewals are necessary. It seems to be the practice there, when a renewal is required, to cut the weld for a distance of about 18 ins. on each side of the joint, and then to insert a new piece of rail, thus getting two joints in place of one. In Liverpool the same difficulty of fractures has arisen.

The foregoing remarks apply to new track welds and it seems to be the general experience that the process is

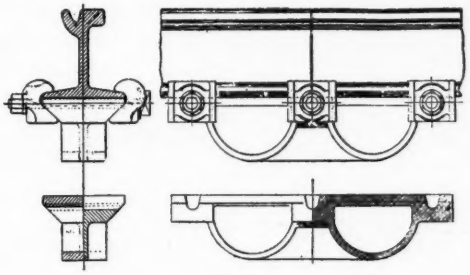


Fig. 4.

THE BULL DOG ANCHOR AS USED IN ENGLISH TRAMWAY WORK.

not well adapted to old track. The important question, therefore, with regard to this method is what is going to be the result in a few years when large renewals become imperative. The solution is not as easy one to suggest at the moment, but putting all practical difficulties aside, the inference is that the cost will be heavy. One of the striking features of the replies received from tramway engineers is the statement, in nearly every case, that no separate accounts are kept of the cost of renewals or repairs to joints.

Among the more prominent types of anchors in use in this country are the following: The "Cooper" anchor, (Fig. 1); the "Winby" anchor, (Fig. 2); the "Kirkland" anchor chair, (Fig. 3); the "Bull Dog" anchor (Ames-Crosta) (Fig. 4); the "Positive" rail anchor (Walker and Grant) (Fig. 5). The anchor joint, in one form or another, appears to have appealed to a great number of engineers, and may be found in use on the majority of tramway undertakings. Anchors are preferred or are used in Burnley, Huddersfield, Bournemouth, Wolverhamton, Birmingham and Darwen. The writer has also put them down throughout a 25-mile system of tramways.

The Cooper anchor, or piece of inverted rail, may be

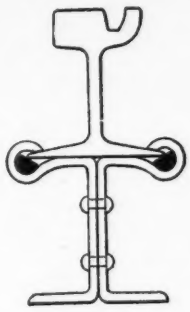


Fig. 5.

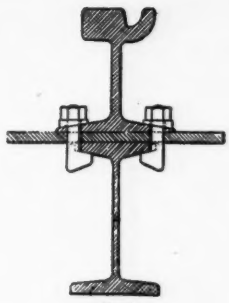


Fig. 6.

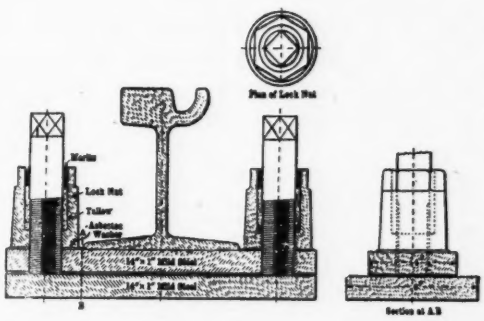
RAIL ANCHORS FOR JOINTS IN TRAMWAY WORK.

fastened to the rail either by bolts or rivets. Bolts are hardly likely to be satisfactory, as, like fish-plate bolts, they tend to work loose. In all cases of anchors at joints, the ordinary type of fish-plate is used, the function of the anchor being merely to prevent springing of the rail ends. The success of this method of jointing depends absolutely on the stability of the concrete in which the anchor is buried, the nature of the soil beneath the concrete, and getting a true alignment on the running surface, without grinding.

On the London County Council tramways the joint adopted, known as the girder joint, is constructed as follows, shown in the accompanying illustration, Fig. 6: A piece of steel H joint, 30 ins. long by 5 ins. wide and 8 ins. deep, weighing 30 lbs. per foot, and a steel plate 30 ins. long by 12 ins. wide by ½ in. thick, are fastened to the rail by 2½ in. by ¾ in. hook bolts. The attachment is made by the hooks of the bolts fitting into slots made in the top of the flange of the joist and fastened through holes in the plate and bottom flange of the rail, and the nuts are screwed down to a level washer. The bolts are made of mild steel, and are threaded for a length of 1½ in. from the nut.

The experience at Burnley is interesting, and tends to bear out entirely the dependence on the condition of the soil and concrete. It is there claimed to maintain a good joint, but that hammering develops after two or three years, when the rail has to be ground. It is further stated to be bad for the rolling stock, and that rigid foundations and hammered joints break the car axles.

With regard to anchor joints generally, it is found here again that their application has been confined to new track work. The expense of excavation and fixing to



ADJUSTABLE RAIL JOINT FOR TRAMWAYS.

old track is too great, to say nothing of the problematical satisfactoriness. It would also involve grinding down the surface of the rail, and that, in addition to being expensive, is never satisfactory.

A combination joint consists of a device in which an attempt is made to distribute the forces and counteract the effects of the hammering and pounding. Several types have already been tried with considerable success, among which reference is made to the following: (1) The "Continuous" rail joint; (2) Booth's continuous rail joint; (3) the "Atlas" joint; (4) the "Dicker" joint.

Several years ago an attempt was made to forge out the fishplate and rail end in one, by means of a portable hydraulic press and furnace. The rail end was formed in such a manner that the joint faces were at an angle of about 30 deg. with the rail edge. The idea was never successful in practice for several reasons. First, the cost was prohibitive; and, secondly, the rails were much shortened in the process. The re-heating also had the effect of softening and injuriously affecting the steel.

The adjustable joint differs in almost every particular from those which have been described herein. It consists of two plates of rolled mild steel, one being superimposed on the other. In the upper plate are two steel screws, having gas threads, and on each screw is a combined protection and lock nut. The apparatus is shown in cross section with the rail in the accompanying illustration. The arrangement is simple, and by slightly turning the screws the upper plate is raised, thereby raising the rail ends and "supporting" the joint. Any depression due to the rolling load or any other cause, is readily adjusted by the use of a box-spanner without any disturbance of the paving. Hence the joint can always be maintained as satisfactory as the rest of the rail. In adopting this type for new tracks, the heavy fishplates can be dispensed with, and shorter mild steel plates substituted.

The question of bonds and bonding is intimately associated with, and directly affected by, the form of jointing device adopted, hence these brief remarks so far as the subject is involved. In considering this part of the subject, the devices may be divided into two classes, viz.:—(a) Those in which the fishplates are retained, and (b) welded joints. The universal practice is to use two bonds per joint in order to obviate the "gathering" of the current, and it is admitted that the best position for them is one at the top of the web and the other at the bottom. It is, of course, not always convenient to adopt that arrangement, owing to the design of the fishplates, and it is much to be regretted that in some cases the better form of fishplates has been sacrificed on account of the bond difficulty. This difficulty has been rendered more complex (and disastrous, so far as the efficiency of the joint is concerned) by the desire to have "concealed" bonds. With the "anchor" joint, the short bond and the concealed bond may be used without seriously affecting the efficiency of the lateral support; with the "combination," or continuous rail joint, the only alternative is to use a long and unprotected bond, thus rendering that method still more expensive.

New Forms of Distant and Home Signals in Germany

By Hans A. Martens

MANY theoretical investigations have been carried out with a view to the improvement of distant and home signals, and many suggestions have been made, based on different assumptions and having different objects in view, but comparatively few practical trials have been made with signals of new forms. At the present time, when trains are continually being accelerated, one of the chief questions bearing on the safety of the traffic, is the necessity of showing very clear signals; more especially is it important that the home signal at stations should be unmistakable and visible from afar. It is true that there is a general agreement as to the defects of a signaling system in which green has different meanings in the distant and the home signal. But any signaling system which would satisfy all the well-known requirements of the newer signaling theories must overcome very great difficulties, although these may not be insuperable. And who desires to take upon himself the responsibility of trying to do away with the existing system, which has grown with the railways and has become part and parcel of the whole railway world? During the time of transition there would be considerable risk that in cases of danger, when the recognition of signals, their interpretation and resolute action are matters of seconds, the driver would become confused by the recollection of the old signals, still fixed in his memory. But progress goes on in spite of all difficulties, and many contributions to this question, from most competent writers, have appeared in these pages. The author may therefore be permitted to give his own personal observations on a modern signaling system, which the Danish State Railway introduced a few years ago, so that it is now no longer in the experimental stage, but is used in current practice. The author, who made a journey of inquiry in the summer of last year, became acquainted with it through the very kind intervention of Mr. Otto Busse, the manager of the Danish State Railway, to whom he once more wishes to express his gratitude. The author proposes to describe and discuss critically the principle of the signals used for entering stations, and how it is applied. For this system is a bold step in advance, and endorsed by experience; that it is satisfactory is shown by the approval of the working staff, and the author can only agree with them, on the basis of his observations made during a number of runs on locomotives both by day and by night.

The fundamental principle of the Danish signaling system is that white light is never used for giving a signal to a train; for, on the one hand, other white lights in the neighborhood may lead to error, and on the other, the possibility that there are colored lights in the neighbor-

*Papers from the Zeitung des Vereins Deutscher Eisenbahnverwaltungen and the bulletin of the International Railway Congress Association.

hood is negligible. Moreover, if there were any such disturbing colored lights, there would probably be no difficulty in having them removed, whereas the white lights of street lamps and of houses could not be interfered with. In order to show how opinions may vary, the author may incidentally remark that the new Amsterdam signaling regulations for main and local lines, of April 30, 1904, specify that white on the main signal means "line clear."

To the remaining two colors, red and green, a third color was added, intermediate between yellow and orange, to which the name "Brandgult" was given. This color has the very great advantage, that a light with a glass screen of that color is visible from further off than one with a red or green screen, so that such a "Brandgult" signal is more easily picked out, whether it is by itself or in conjunction with red or green lights. The author found this property a great advantage, when on a locomotive on night runs; he did not know the track, and on every occasion the "Brandgult" light gave him the line of sight enabling him to find the second upper light of the main signal, which was not visible from so far. Thus the "Brandgult" signal in this way prepares for "caution" or "stop;" and this is of importance as by no means all main signals are supplemented by distant signals. Thus an absent distant signal is ingeniously replaced, to some extent, by the "Brandgult" light, visible from afar, of the main signal. The author is unable to state in figures what the superiority of the visibility of "Brandgult" as compared with red and green amounts to; but it seemed to him that the visibility in clear weather was such that express trains could be stopped with certainty before the main signal was reached. Whether the practical value of this signal may be affected by color-blindness, is a question which requires careful investigation. No danger would arise if it were mistaken for red; for with red it simply emphasizes "stop."

Another principle on which the Danish signal system is based is the use of two blades, together with their lights, on the main home signal. This reduces the risk of total absence of light, at nights, to practically nil, unless through some unforeseen accident both lights are extinguished simultaneously. As two signal lights must always be visible, it can at once be seen with certainty if one light has gone out; and in such a case caution must be exercised in entering the station, or else inquiries must be made at the signal cabin. In no case can "line clear" be shown.

The main signal has one upper large blade with a disk-shaped end, and below this a smaller blade with a swallow-tailed end. Red light and "Brandgult" light correspond to the horizontal positions of the upper and lower blades respectively. Green light corresponds to the oblique position of both blades. The two lights are placed vertically one above the other. Both blades are horizontal for "stop;" at night the upper light is then red, the lower "Brandgult." "Slow entrance" is given by the oblique position of the upper blade and the horizontal position of the lower. At night the upper light is green, the lower remains "Brandgult."

"Free entrance with unreduced speed" is shown by both arms set obliquely, with two green lights.

The distant signal consists of a low semaphone signal, the blade having the same shape as the lower blade of the main signal. The horizontal position corresponds to "Brandgult," the oblique position to green.

When the chief signal is at "stop" the distant signal gives by the horizontal position of its blade (at night by the "Brandgult" light) the order "proceed slowly."

When the chief signal is at "line clear" the blade of the distant signal is in the oblique position (green light), and indicates "line clear."

The following principles apply to the signaling:

1. The distant signal prepares for the main signal, without specially indicating whether the entrance is to be free or at reduced speed;

2. The distant signal is clearly different from the main signal, if no light becomes extinguished;

3. A difference is made between entrance at reduced speed and at unreduced speed. The first signal is given to all trains which run through, while the reduced speed signal is given to all train stopping at the station. This also includes entrance by diverging switches, as it is assumed that all trains stopping at the station run through such switches sufficiently slowly. But at very large stations this may possibly not always be the case, if the switches in question are at any distance from the station platforms. A further assumption made is that express trains running through are as a principle not diverged by switches.

The correct sequence of the signals shown is worthy of attention. Any double meaning of a light or a signal is wholly avoided. On the contrary, a happy connection is effected between the different constituent parts of the signals. The "Brandgult" light, visible from afar, of the distant and main signal enjoins cautious, slow progress; at the main signal it is supplemented by red for "absolute stop" and by green for "proceed slowly." Free entrance at unreduced speed is given by both blades in the oblique position with the corresponding two green lights, with so to say double emphasis. To German notions it may seem strange to run past the horizontal blade of the distant signal in the day time. But if we remember that absolute stop is indicated at the main signal by two horizontal arms, this by itself justifies the two signal forms, which are different in their nature. Just as the lower light of the main signal supplements the upper light at night, so the lower blade supplements the upper blade in the day time.

It seems advisable to compare with this non-German signaling system the latest signaling trials made by the Bavarian State Railway on the subject of distant and main signals, as there are based on very nearly the same principles; but the solution adopted has resulted in forms of signals which are materially different. The white light for "line clear" is also eliminated. Green indicates "free entrance," without any limitation. Double yellow indi-

cates "caution," *i. e.*, reduced speed. Yellow is anyhow only used for double lights, in order to obviate the risk of mistaking any other white or dully-burning lights. Running through when diverging switches have to be traversed is prohibited. If it should become necessary to diverge by switches non-stopping trains, these must stop at the station, and they are accordingly treated for signaling purposes just like the regulation stopping trains.

When the main signal is at "stop," the distant signal shows double yellow obliquely up to the right; when the former is at "line clear," the latter shows double green obliquely up to the right. The kind of entrance is thus not indicated at the distant signal, as required by some signaling engineers. The old German forms of signals are retained for "stop" and "free entrance with unreduced speed," for both the day and the night signals. Attention may here be drawn to the great value of this adhesion to former practice. The "proceed slowly" for divergent routes is indicated by two oblique blades, with double yellow. The divergent entrance route is thus indicated as such, while the Danish signaling system only recognizes the conception "entrance of a train stopping at the station," with the tacit assumption, mentioned above, as to running over diverging switches.

The desire to retain the existing forms of the German signals as much as possible is unmistakable in this system. The transition from the old to the new system is thereby effected with less risk to the traffic. Thus, for instance, the divergence signal shows, as at present, two blades with two lights, one vertically above the other, showing yellow instead of green. The disadvantage, that if one of the lights of the main signal goes out, no signal is shown, is however not eliminated, although it is desired to provide for this in modern systems. Distant and main signals can be clearly distinguished from each other, provided no light is accidentally extinguished. The correct sequence of the meaning of the colors is retained: double yellow on both signals means "proceed cautiously," green on both signals means "clear," and further particulars are given by the number and the arrangement of the lights. It is, however, much to be regretted that the distant signal disk is retained, which as a yellow disk with black border will lose still more of its visibility, an instance of how difficult it is for some to give up old traditions. Much will have been done to contribute to the safety of the traffic, if the low distant signal disk is abolished, which in the "danger" position is visible with difficulty, and in the "safety" position can make no claim to be visible from afar; so that, as a rule, the main signal is seen before the distant signal. Attempts are made to overcome this defect by putting up conspicuously painted walls at the bottom of the distant signal pole. The disk signal, which it is so difficult to see, should therefore be replaced in any modern signaling installation by a clearly visible semaphore signal.

It may be asserted that the two signaling systems described represent a distinct improvement, as they enable three important indications for entering trains to be expressed by simple signal forms, without ambiguity. If the theory of signaling is to remain a simple one, we must succeed in removing all the known defects of the existing signaling systems by the introduction of a new system, which may show unusual forms of signals, but which in every way satisfies the requirements of modern railway practice, particularly as far as high-speed trains are concerned.

By Mr. Forderreuther.

The valuable note, by Mr. A. Martens, in No. 8 of this paper, on the subject of the signaling system of the Danish State Railway, induces me, in connection with the comparison made with the signaling experiments in Bavaria, to make the following remarks:

The introductory remarks might lead to the belief that on the Bavarian State Railway green has a double meaning on distant and main signals, and that trials of new signals are made for this reason. This is, however, not the case. For more than twenty-five years, the Bavarian State Railway has consistently been using the so-called "white light" as a signal for "line clear and unreduced speed," on distant signals as well as on main signals. This has made it possible to give to "green" one consistent meaning "go slowly, caution." In order, however, to arrive at one uniform system of signaling on all German railways, the question of abolishing white-light signals is being considered, particularly as in consequence of the increased speeds and the better lighting of stations it becomes of greater importance that colored signals should be more easily picked out among white lights, and that if a red or green light were extinguished a white light in the same line of sight might lead to mistakes.

It is, however, possible in many cases to prevent the possibility of any mistake by suitable arrangement and partial covering of the white lights and lanterns, and no danger results from the extinction of one single light in the set of signals usual in Bavaria, where the home signal and the starting distant signal are on one and the same pole; the adoption of "green" instead of "white" for "line clear" will therefore probably be postponed, until an equally valuable substitute for "green" has been discovered, and accepted by all the German railway managements.

Not only in Bavaria, but also in several other German states, are experiments being made, on definite agreed lines, with a view to discovering such a new night signal. In the more recent Bavarian trials, experiments have more especially been made with the double light, red-yellow, proposed by the management of the Saxon State Railway; this light, like the "Brandgult" light, shows up well in any state of weather. All distant entrance signals show "double yellow obliquely upwards to the right" for "danger." Signal 5 is given by a horizontal arrangement of the two yellow lights with two lanterns, and also with one lantern and reflection. The starting distant signals, which are definitely to be found at all Bavarian stations through which regular trains run without stop-

ping, are, as stated above, placed on the poles of the home signals. Double yellow, as well as single yellow, was tried experimentally for these distant signals, which are thus never visible alone, but always in combination with the home signals. When "stop at home signal" is indicated, the starting distant signal also shows "red," so that the main danger signal is given by two red lights. The upper blade of the main signal has its end pointed, the lowed blade rounded. At night, the light of the upper blade is at first green or yellow, according as this blade alone, or together with the lower blade, is brought into the "line clear" position. More recently the "line clear" position of the upper blade always corresponds to "green," that of the lower blade to "yellow." It is true that there are no diverging switches on the experimental line, but this is probably not to be laid down as a general principle in future.

As the author correctly remarks, the distant signal only shows two signals, namely, "caution" when the main signal is at "danger," and "line clear" when it is clear either for the main line or for a diverging line. I expressed myself in favor of the introduction of a third signal in this publication, of February 17, 1906. As other means, such as, for instance, wireless telegraphy, are not yet available, I would still recommend this at present on sections where there are very fast trains, so that the troublesome informing of trains regarding alterations from the regular schedule, may be obviated and the safety increased. I must, however, admit that further trial proved that the signals then proposed, with the comparatively dull petroleum lamps, were not suitable, as they were not sufficiently visible in times of fog and snow. As yet no other suitable form of night signal, enabling a distant signal to give three separate indications, has been discovered. In the Danish form of distant signals, it is true that a third indication may be obtained by the blade hanging obliquely downwards and by the colors "green and yellow." The "green" appearing if "yellow" is extinguished cannot by itself become dangerous, as in all three cases two lights are always necessary for the indication. It would only be dangerous if the Danish "yellow" were to outshine the "green" and "red" lights, so that only "yellow" would be visible at a distance. The same apprehension might be felt in the case of the Danish main signal; but in that case the distant signal has already indicated whether "stop before the station" or "stop at the station" is signaled.

As regards the recommendation to replace the distant disk signal by a semaphore blade, I do not believe that this is any material improvement. If "stop at main signal" is always represented by two horizontal blades, which would be rather an expensive matter for the more important railways as there are at present so many one-blade signals in existence, the one single smaller horizontal blade can certainly be distinguished; but it is probable that the necessary respect for the "stop" signal would be somewhat reduced, if in its appearance it at all resembled the "line clear" signal. The only advantage of this arrangement is that there is a material difference between the day signals of the distant signal and of signal 5. The additional advantage of a positive signal for "line clear" can, however, also be obtained by other means, as, for instance, in Bavaria by a disk, which can be folded back to form an oblique blade. As the disk is always at the level of the driver's eye, it cannot easily be overlooked, particularly as owing to its shape, very different from that of an oblique blade, it impresses itself on the driver as a sign of caution. Moreover in Bavaria it distinguishes itself, by its position to the right of the pole, from the lower disk of signal 5, which is placed centrally on its support. The yellow color with black border is at present only being tried experimentally for disks. The color will be changed if the results obtained show this to be desirable, as it is the shape, not the color of the day signal, which is the important feature.

Egmore Station, Madras, South Indian Railway

For some time it had been felt that the traffic to be handled in Madras had outgrown the accommodation provided for it at the Egmore Station, and that something better was required than the old-fashioned cramped station which had done duty for many years as a terminus for the South Indian Railway.

Mr. Henry Irwin, C. I. E., was therefore invited to design a building suitable to the needs of the traffic, and worthy of the city of Madras. After many alterations in his plans, the building, which was thrown open on the 11th of June last for use by the public, was decided upon.

The building is after a Mogul style of architecture, built of brick relieved with handsome granite and Thada sandstone work. There is a granite plinth on the road frontage up to basement level, and the intricate stone carving, fantastic-shaped brackets, drip stones and rich friezes at once attract the attention of any observer to the excellence of the structure from an architectural point of view. The fine carved granite stone work of the porches, one opposite the 1st and 2nd class and the other opposite the 3d class passenger entrance, is worth particular notice. From a distance the symmetrically placed towers, and small characteristically shaped semi-circular domes present a fine appearance against the sky line and lead one to expect, what is realized on a close approach, that the station, ranks as one of the most beautiful of the public buildings in the city of Madras.

The main building (330 feet long by 71 feet wide) is two stories high. The lower floor, at platform level, is occupied by refreshment rooms, waiting rooms and the usual offices for the station staff, also the post office. At the east end of the building there is a single story extension (67 feet by 45 feet), in which a large and well appointed luggage and parcels office is provided, and beyond this another single story building (90 feet by 20 feet) for the government railway police and for lamp and store rooms.—*Indian Engineering.*

The Cause of Increased Lumber Cut

Figures of the lumber cut in 1907 compiled by the Bureau of the Census and the Forest Service showed the largest total ever reported in the United States, exceeding by over seven per cent the cut reported for 1906, until then the record year. This does not necessarily show a larger actual cut than in 1906, for the returns obtained last year were more complete than ever before. The figures themselves disclose some interesting facts.

In 1907, 28,850 mills made returns, and their production was over 40 billion feet of lumber. This is believed to include 95 per cent of the actual cut. In 1906, 22,398 mills reported about 37½ billion feet. Since according to these figures nearly 29 per cent more mills reported last year than the year before, while the increase in production was only a little over seven per cent, it might be thought that the amount actually manufactured must have been greater in the earlier year. This, however, would be a too hasty inference, for it is almost wholly among mills of small individual output that the gain in the number of establishments reporting has been made.

A classification of the returns by states and regions throws additional light on the situation. Individual changes, as for example the remarkable rise of Texas from eighth to third place among the lumber-producing states, are doubtless accounted for primarily by the greater accuracy of the 1907 figures; but in the majority of the cases the advances and declines can be traced to specific influences.

Before the year closed the general business depression was severely felt in the lumber industry. It was not, however, the most important cause of a falling off in the production of the year where a falling off occurred. For decline in production took place only in certain regions. The South is the region of greatest activity in lumber production, and yellow pine the most important wood, forming 33 per cent of the entire cut of the country. The cut of yellow pine reported shows an increase of 13 per cent over that of 1906. In the early part of the year many of the southern mills cut so heavily that, in spite of the curtailed output which followed the business disturbance later, the total was greater than ever before. But in both the lake states and the northwest a smaller cut was reported than for 1906, though the number of mills reporting increased.

In the lake states the falling off evidenced the waning supply of white pine. Michigan, which for many years led all the states in lumber production, and then gave way to Wisconsin, sank in 1907 from fourth to seventh place, while Wisconsin went from third to fifth. Minnesota as late as 1905 held fourth place. Last year it went from seventh to ninth. It was not until the latter 90's that the south displaced this group of states as the most important source of lumber supply. Since southern pine is abundant in all the Atlantic coast states from the Carolinas to Texas, the region as a whole will doubtless maintain its leading position for some years, in spite of the fact that at the present rate the bulk of the timber will be gone in another decade; but in totals of production by individual states the leadership has since 1905 been held by Washington.

The figures of production show that during 1907 Washington fell off very decidedly from its huge cut of 1906, while its sister state Oregon is credited with a slight increase in its total. In the early part of the year Washington suffered from a car shortage, and at the end the combined effects of business disturbance and higher freight rates had brought the industry almost to paralysis. Oregon kept up its cut because of its larger proportion of coastwise and foreign trade. These two states together produced more lumber than any other two states in the Union.

It is a striking fact that though lumber prices have been steadily going up during the last half century, the per capita consumption of lumber has also been going up. In 1850, according to the best figures obtainable, the average consumption to each person in the country was 250 feet, in 1900, 460 feet, and in 1907, 480 feet. This illustrates what has been found true the world over—that with industrial progress the demand for wood becomes greater and greater.

Rebuilding the Quebec Bridge

A board of engineers has been appointed by the Canadian government at Ottawa, Ont., to rebuild the Quebec bridge which collapsed with a loss of eighty-four lives. Henry E. Vautellet, former bridge engineer of the Canadian Pacific Ry., and Maurice Fitzmaurice, chief engineer of the London County Council, England, and Ralph Mojeski, of Chicago, are the members. Mr. Fitzmaurice was associatd with Sir Benjamin Baker in building the Forth bridge in Scotland, and later was in charge of the Assouan dam in Egypt.

Jury on Track Construction

A corner's jury empaneled at Greenwich, Conn., on July 23, to inquire into the wreck of an express train, on the electrified section of the New York, New Haven & Hartford Railroad, near that place on July 16, reached a verdict that the wreck was due to spreading rails, and the spreading of the rails was due to "negligence of the railroad in not tie-plating the track." The verdict was as follows: "The undersigned jurors having been summoned and duly empaneled and sworn to inquire into the cause and the manner of the death of Marguerite Armstrong, aged 18 years, who met her death on the 16th day of July, 1908, having seen the body and place of her death, and having heard the testimony of witnesses, hereby find that she met her death from a broken spine, caused by the derailing and overturning of a car of the New York, New Haven & Hartford Railroad, due to the spreading of the rails at that point, she being a passenger on the train; that the New York, New Haven & Hartford Railroad was negligent in not tie-plating the entire track. In our opinion there would have been less probability of derailment if the track had been tie-plated."

New Zealand Hardwoods

Far-off New Zealand is the latest country to which forest experts have turned in seeking substitutes for the valuable American woods used by the furniture, cooperage, implement and similar wood-using industries.

Manufacturers in this country have been facing a constantly decreasing supply of available hardwood timber for a number of years and the time is already at hand when efforts must be made to look to the preservation of the American species most in demand and to scour foreign lands for trees which may prove valuable as substitutes.

Seven different New Zealand hardwood trees have just been put through a series of tests by the United States Forest Service in cooperation with the University of California in the timber testing laboratory at Berkeley. The trees showed up remarkably well in comparison with white oak, which is one of the strongest woods in the United States, developing under test when in an air dry condition a crushing strength of 8,500 pounds per square inch and a bending strength of 13,100 pounds per square inch.

Four of the seven New Zealand woods tested developed a bending strength even greater than white oak and three of the woods showed a great crushing strength. The New Zealand woods found to have a bending strength as high or higher than oak were the Black Maire, Matai, Puriri, and silver pine, while the first three of these have in addition developed a greater crushing strength than oak.

An idea of the true strength of these woods is given in the technical report which shows that with white oak at 1.00 the compressive or crushing strength of the New Zealand woods is as follows: Black Maire, 1.18; Matai, 1.05, and Puriri, 1.21. The woods which developed an equal or greater bending strength are as follows: Matai, 1.22; Silver Pine, 1.00; Puriri, 1.41, and Black Maire, 1.56. The last figure shows that this wood has more than one and one-half times the bending strength of oak.

The woods tested which fell below the strength of oak (1.00) were Rimu, .68 for compression or crushing strength and .86 for bending; Kauri, .70 for compression and .94 for bending, and Totara, .57 for compression and .70 for bending. The showing even for the last three woods is not bad when it is considered that the compression is made with clear straight-grained white oak.

These strength tests of seven of New Zealand's most valuable timbers may prove of the greatest benefit to certain American manufacturing interests if experiment shows that the woods can be introduced into this country and planted with the same success as the eucalyptus of New Zealand and Australia or if it is found that the islands have enough of the various species to import a little to this country.

The United States will not be able to depend on imports to any great extent, for wood users realize that there is an approaching shortage of timber in other countries as well as this, and each nation must cultivate and protect its own forests. It is, therefore, likely that planting experiments will be made with many of the valuable foreign woods, in view of the success made with the eucalyptus in California.

American hardwoods are in a constantly decreasing supply and if foreign trees are found to meet the same uses to which white oak and hickory are put it will afford an opportunity to replenish the native supply by well directed planting. The hardwoods practically all grow in the eastern and central western states, where there are no national forests, although a plan has been proposed a number of times for their establishment in the White Mountains of New England and the Appalachians in the South. For the present the protection and conservation of the country's hardwood resources depend upon the individual and corporations which own the land.

Preservative Treatment of Loblolly Pine Cross-Arms

ALL who are familiar with wood preservation know that the ease with which the preservative can be injected depends upon the character and condition of the wood. Porous species, such as red oak and certain pines, absorb the liquid more readily than such dense woods as tamarack and hemlock. In a single species, timber cut from open-grained fast-grown trees takes treatment more readily than that from trees which grow slowly, with a consequent close grain; porous sapwood receives the liquid more readily than the denser heartwood, the pores of which are more or less filled with oils and other infiltrated organic substances; and wood is easier to treat when dry than when a large amount of water in the cells presents a mechanical resistance to the entrance of the preservative. In small timbers, which receive an absolute penetration, the difference in absorption is more apparent than in the treatment of large dimension stuff, merely the outer layers of which are impregnated.

The cross arms manufactured throughout the South are cut mainly from rapidly grown, open-grained loblolly pine. No distinction is made as to species, however, and shortleaf and longleaf are frequently included. At present cross arms cut from various parts of the tree are mixed indiscriminately; hence cross arms cut from heartwood are treated with those cut from sapwood, and those which have reached an air-dry condition with freshly cut or rafted material. As a consequence, the amount of preservative forced into the wood varies greatly; the dry sapwood material receives more than is required and the heartwood not enough.

PRELIMINARY TESTS.

These considerations induced the Forest Service, in February, 1903, working in co-operation with the American Telephone and Telegraph Company and the Norfolk Creosoting Company, to make a series of six experimental runs at the latter company's plant near Norfolk, Va. The principal objects of this test were

to demonstrate the inequality of the treatments received by different classes of material and to furnish a basis for more detailed work in the future, with a view to rendering the treatments more uniform and economical.

For creosoting under pressure, the timber is piled in small trucks or buggies, hauled into large, air-tight horizontal cylinders, and the doors tightly closed. Live steam is then admitted for varying lengths of time, usually for from three to six hours, according to the character and dryness of the wood. The steam is then expelled and a vacuum drawn for several hours to exhaust the air and water remaining in the wood cells. Creosote (dead oil of coal tar) is then allowed to run into the cylinder from one of the storage tanks. When the oil appears in the overflow pipe, indicating that the cylinder is full, force pumps are started, and the resulting pressure is maintained in the cylinder until the desired amount of oil per cubic foot of timber has been forced in. This amount has previously been calculated for the entire load, and when the indicator on the storage tank shows that the required amount of oil has been drawn from the tank the supply is shut off, and that which remains in the cylinder is forced back into the storage tank. The treated load is left to drip in the cylinder for a short time, and is then hauled out and unloaded.

GRADING THE ARMS.

Before the treatment was begun 14,000 arms were separated into three classes, in accordance with the relative amounts of heartwood and sapwood each arm contained. Class A was composed of arms with 75 per cent or more of heartwood; Class B, 75 per cent or more of sapwood; and Class C contained less than 75 per cent of either heartwood or sapwood. No attempt was made to separate the arms according to the amount of moisture they contained, hence nearly green and partially air-dry arms were represented in the same class. Six runs were made in these preliminary experiments. In order to ascertain the exact absorption of oil, a number of arms of each class were weighed before treating and so marked that they could readily be identified and weighed after the treatments were finished.

SUMMARY.

The results of the entire study are summarized in the following recommendations:

1. During the process of manufacturing the arms they should be graded into three classes: Arms that contain at least 75 per cent of heartwood; arms that contain at least 75 per cent of sapwood, and arms that occupy an intermediate position.

2. The arms should next be piled in the seasoning yard until they have approached an air-dry condition. The form of the pile should be 20 by 20, with the two end and middle arms turned with the wider sides vertical. In winter the piles should be covered with a roofing of plank to protect the arms from snow and rain. The seasoning yard should be so situated as to afford full access to the winds, and avenues at least 4 feet wide should be left between the piles so as to allow currents of air to flow freely on all sides of the timber.

3. If it has been possible to season the timber at the mill, each class or grade should, when the arms have approached an air-dry condition, be loaded in separate cars and shipped to the treating plant, where they can be unloaded directly on the cylinder buggies. During this unloading the inspector will have a chance to check up the inspection and grading at the mill.

4. Each class of arms should be treated separately. The usual preliminary bath of live steam should be omitted. A vacuum should be applied only sufficient to draw the oil from the storage tanks into the treating cylinder. If the arms belong to the sapwood class, no pressure is necessary in most cases, but care should be taken to apply sufficient pressure, if necessary, to penetrate the heartwood portions of the arms. The exact amount of oil absorbed by the timber should be carefully noted. When the impregnation has been completed the surplus oil should be blown back into the storage tanks and a vacuum drawn in the treating cylinder. From time to time the oil which is forced out of the timber by the expansion of the air during the vacuum, and which collects in the bottom of the cylinder, is blown back into the storage tanks. The vacuum should be continued until only the desired amount of oil is left in the timber. It is recommended that the arms of Class A (heartwood) should finally contain about 6 pounds per cubic foot; the arms of Class C (intermediate) about 8 pounds per cubic foot, and the Class B arms (sapwood) about 10 pounds per cubic foot.

The cylinder doors are then opened, and the treatment is complete. The total length of the average treatment will probably fall considerably under two hours.—From Circular 151, Forest Service, U. S. Department of Agriculture.

Prices on Track Materials, F. O. B. Chicago

Steel rail, 60 lbs. and over	$28.00 per gross ton
Steel rail, 25 to 45 lbs	28.00 per gross ton
Steel rail, 20 lbs	29.00 per gross ton
Steel rail, 16 lbs	30.00 per gross ton
Steel rail, 12 lbs	31.00 per gross ton
Ties, 6x8x8 oak, 1st grade	74c each
Ties, 6x8x8 oak, 2d grade	67c each

Angle bars, accompanying rail orders, 1908 delivery, 1.50c; car lots, 1.60c; spikes, 1.80c to 1.90c, according to delivery; track bolts, 2.20c to 2.25c, base, square nuts, and 2.35c to 2.40c, base, hexagon nuts. The store prices on track supplies range from 0.15c to 0.20c above mill prices. Switch set per turn out, 60-lb. rail, $85 to $90.

OLD METAL.

Old steel rails, rerolling	$15.75 to $16.25
Old steel rails, less than 3 ft	14.25 to 14.75
Old iron rails	16.75 to 17.25

SHEET STEEL.

It is quoted for future delivery:

Tank plate, ¼-in. and heavier, wider than 6¼ and up to 100 ins. wide, inclusive, car lots, Chicago, 1.78c; 3-16 in., 1.88c; Nos. 7 and 8 gauge, 1.93c; No. 9, 2.03c. Flange quality, in widths up to 100 ins., 1.88c, base for ¼-in., and heavier, with the same advance for lighter weights; sketch-plates, tank quality, 1.88c, flange quality, 1.98c. Store prices on plates are as follows: Tank plate, ¼-in. and heavier, up to 72 in. wide, 2.00c to 2.10c; from 72 to 96 ins. wide, 2.10c to 2.20c; 3-16 in. up to 60 in. wide, 2.10c to 2.25c; 72 ins. wide, 2.30c to 2.40c; No. 8 up to 60 ins. wide, 2.10c to 2.15c; flange and head quality, 0.25c extra.

STRUCTURAL STEEL SHAPES.

Store quotations are at 1.95c to 2.00c, and mill prices are as follows: Beams and channels, 3 to 15 ins., inclusive, 1.78c; angles, 3 to 6 ins., ¼ in. and heavier, 1.78c; larger than 6 ins. on one or both legs, 1.88c; beams, larger than 15 ins., 1.88c; zees, 3 ins. and over, 1.78c; tees, 3 ins. and over, 1.83c, in addition to the usual extras for cutting to extra lengths, punching, coping, bending and other shop work.

CAST IRON PIPE.

Quotations per net ton on water pipe, 4 ins., $27; 6 to 12 ins., $26; over 16 ins., $25; with $1 per ton extra for gas pipe.

CEMENT.

Good grade Portland cement, car lots...$1.65 per bbl.*

* (Four sacks per bbl. credited 10c. each when returned in good condition.)

SAND.

Bank sand, car lot .....$0.75 per yd.
Torpedo sand, car lot..... 1.15 per yd.

CRUSHED STONE GRAVEL.

Crushed limestone, car lot.....$1.05 per yd.
Crushed gravel, car lot..... 1.10 per yd.

Personal Mention

The college of engineering of the University of Illinois announces the following new appointments for the college year beginning September 16: Mr. F. D. Crawshaw, B. S., in electrical engineering, Worcester Polytechnic Institute, '96, who has served as head of the manual training department of the Central High School, Minneapolis, Minnesota; as first assistant, manual arts department, Bradley Polytechnic Institute; and as principal of the Franklin School, Peoria, Ill., to be assistant dean of the college of engineering; Mr. Frank B. Sanborn, B. S., Dartmouth, '87, C. E., Dartmouth, '89, M. S., Harvard, '98; for nine years past professor in charge of the department of civil engineering, Tufts College; has been granted leave of absence for one year by that institution and during this time will act as assistant professor of civil engineering with the University of Illinois, doing work not otherwise provided for during the prospective temporary absence of leave of Professor I. O. Baker; Mr. Shelby S. Roberts, B. S., Rose Polytechnic Institute, '98, C. E., Rose, '07; for the past ten years engaged in railway work, chiefly with the St. Louis, Peoria & Northern Railway, the Louisville & Nashville, and the Illinois Central, has been appointed assistant professor of railway civil engineering. Mr. Roberts will give his entire attention to instructional and research work with reference to railway track construction and maintenance and with reference to railway signaling; Mr. William F. Schulz, a graduate of the Baltimore Polytechnic Institute in 1890, an honor man at Johns Hopkins University, '93, Bachelor of Science in Electrical Engineering, University of Illinois, '00, Ph. D., Johns Hopkins University, '08, and for five years assistant and instructor in physics at the University of Illinois, has been appointed assistant professor of physics; Mr. Kenneth G. Smith, A. B., University of Chicago, '96, B. S. in mechanical engineering, University of Illinois, '05, for three years with the Kerr Turbine Company, has been appointed to have charge of the engineering experiment station extension work with the rank of assistant professor of mechanical engineering; Mr. A. St. J. Williamson, University of Illinois, B. S. in mechanical engineering, '98, M. E., '02, and for the past seven years engaged in railway work, chiefly with the Mexican Central Railway, has been appointed instructor in railway mechanical engineering; Mr. C. F. Kelley, A. B., Harvard University, '06, a student with De Camp and other noted artists, has been appointed instructor in architecture; Mr. C. C. Albright, B. S., Purdue University, '03, C. E., '08, and for the past five years engaged in railway work, has been appointed instructor in civil engineering; Mr. A. R. Lord, B. S. in Civil Engineering, University of Maine, 07, and for the past year instructor in civil engineering of the same institution, has been appointed instructor in general engineering drawing.

The office of chief signal supervisor of the New York Central & Hudson River has been abolished. A. J. Loughren, signal supervisor at Spuyten Duyvil, N. Y., has been appointed signal supervisor of the western division, with headquarters at Rochester, N. Y., succeeding M. M. Hayes, transferred. The authority of C. H. Wiegand, signal supervisor of the Hudson division, has been extended to include the Exterior Zone, formerly under the supervision of Mr. Loughren.

Mr. E. T. O'Dowd, roadmaster of the Atchison, Topeka & Santa Fe at Cleburne, Tex., has been appointed inspector of ties at Galveston, Tex. T. J. Pargen, yard foreman at Temple, Tex., succeeds Mr. O'Dowd. C. F. Eyster succeeds Mr. Pargen.

Mr. Clarence G. Vaughn, C. E., recently connected with the Southern Pacific System, died at Natchez, Miss., on Aug. 4.

Mr. T. F. Tyler, division engineer of the Franklin and Clearfield branch of the New York Central & Hudson River R. R. has resigned.

Mr. J. S. Mallard has been appointed roadmaster of the Georgia Coast & Piedmont, with headquarters at Darien, Ga.

Mr. D. Hurley has been appointed assistant roadmaster of the northern division of the Colorado & Southern Ry.

Mr. J. J. Cozzens has resigned as chief supervisor of signals of the New York Central Lines, with headquarters at Syracuse, N. Y.

Mr. M. H. Hovey, signal engineer of the Illinois Central R. R., with headquarters at Chicago, has resigned to become inspector for the signal and train control board of the Interstate Commerce Commission, effective Sept. 1. Mr. N. E. Baker, assistant signal engineer, succeeds Mr. Hovey on the Illinois Central and Mr. H. F. Lomas is appointed assistant signal engineer.

Mr. D. B. Bartholomew, assistant supervisor of signals of the Pennsylvania R. R., at Kittanning, Pa., has been transferred to the West Jersey & Seashore R. R., with headquarters at Camden, N. J.

Mr. Frank Rhea, engineer of maintenance of way for the Pennsylvania Lines at Logansport, Ind., has resigned, to take charge of the signaling department of the General Electric Co., at Schenectady, N. Y. The change was made effective Aug. 23, and Mr. Rhea is now in Schenectady. Mr. Rhea has been connected with the Pennsylvania Lines for a long time, formerly in the signaling department. Four or five years ago he was made engineer of maintenance of way, and while he was, after this, not as intimately concerned with the signaling work as before, he nevertheless had entire control of the signaling of his division. He has long been regarded as one of the leading signal engineers of the country, and his work with the committees and in the discussions of the Railway Signal Assn. has been highly appreciated.

Trade Notes

The trustees of the University of Illinois have recently let the contract for a new building for its College of Engineering, to be occupied wholly by the Department of Physics. The structure is to be built by B. Jobst & Sons, of Peoria, Ill.; and is to cost, with its equipment, $250,000. It is to be erected just east of the present engineering building, and is to be known as the physics building. The same contractors, B. Jobst & Sons, have been awarded the contract for an addition to the natural history building, for which the last legislature appropriated $150,000.

An attractive little booklet of envelope size entitled "Dixon's Ticonderoga Flake Graphite," has been received from the Joseph Dixon Crucible Company, Jersey City, N. Y. It is printed in two colors, black and red, and this color scheme is carried out on the cover by using a black cover stock and red ink for printing the cover design, which shows a title in the form of a seal. Inside the matter is arranged page for page, each page dealing with some particular phase of the graphite subject. At the bottom of the page is given "third party's" testimony, bearing whenever possible on the particular phase treated on that page. Anyone who is interested in machinery of any sort will probaly find in this booklet some matter to interest them. It is not lengthy, quite the contrary, but some interesting and valuable information is given. Any of our readers desiring a copy of this new Dixon booklet may secure it by writing direct to the Dixon company.

The Raymond Concrete Pile Company, of New York and Chicago, has received the contract for placing Raymond concrete piles under the new hospital extension which is to be erected on Island No. 2 at the U. S. Immigration Station, Ellis island, New York. This is the sixth contract awarded the Raymond Concrete Pile Company for the placing of concrete piles at this station. The general contractors are the New York State Construction Company, under the supervision of James Knox Taylor, supervising architect of the treasury department; Alfred Brooks Fry, superintendent of U. S. public buildings, and Frank S. Howell, civil engineer, U. S. Immigrant Service.

The Rodgers Ballast Car Company, Chicago, has just issued their 1908 Reference Book. The following points are noted: First, the book contains the latest data regarding various types of cars, with halftone illustrations; second, the very extensive use of these cars is indicated by the number of foreign names shown among purchasers; third, the last two pages contain a very carefully made up list of users of Hart convertible cars, and fourth, that copies of the book are furnished upon request.

The McClintic-Marshall Construction Company, Pittsburg, works at Rankin, Carnegie and Pottstown, Pa., has recently made a shipment to the Chicago & Northwestern Railroad of 56 cars loaded with 1,500 tons of structural steel, including 96 girders each 60 ft. in length, together with braces, cross frames and other shapes to be used in the erection of a bridge a mile east of Kansas City.

The Hayes Track Appliance Co., Geneva, N. Y., announces the establishment of a factory at Hamilton, Ontario, to supply the demand for Hayes derails in Canada.

The Baird Railway Steel Tie Co., Topeka, Kan., has purchased of E. J. Grubel a foundry building and tract of land at Topeka, Kan., for $12,500 and will begin the manufacture of steel railway ties. The officers of the company are: President, Archibald M. Baird, of Topeka; vice-president, J. W. Butterfield; secretary, J. L. Atwood, and treasurer, E. D. Coon.

The Atchison, Topeka & Santa Fe Railroad has awarded contracts for the construction of a 10-stall brick roundhouse and standard frame sand house to C. A. Fellows, Topeka, Kan., and for a mechanical coaling station to Fairbanks, Morse & Co., Chicago, Ill. These buildings are to be erected at Canadian, Texas.

The Ketcham Iron Works Company, New York, has been awarded the contract by the New York Central Railroad, at $75,000, for furnishing and erecting the steel work for the new erecting shop at West Albany. The building is to be 90x450 ft.

The Indiana Tie Co., Evansville, Ind., is reported to have increased its capital, $37,000, with a view of constructing an addition to its wood tie preserving plant.

Technical Publications

THE BUILDING MECHANICS' READY REFERENCE, by H. G. Richey. Published by John Wiley & Sons, New York. Leather binding, 433 pages, 4x6¾ ins., illustrated.

The book is devoted to cement and concrete and is written so that it may be used by mechanics. It is not written from the engineer's point of view, but it gives data and information in clear and concise form to expedite the mechanic's work.

The first part is devoted to cements and the second to concrete. The third part covers mortars and material for making reinforced concrete, forms and centering, etc., and also gives methods of doing work. The fourth part is on sidewalk construction, curbs, etc., and contains various cement and concrete tables. The fifth part is devoted to building blocks. The sixth part is given to plasters and plastering for mechanics engaged in such work. The last section contains rules for superintending concrete construction, miscellaneous tables and other valuable data.

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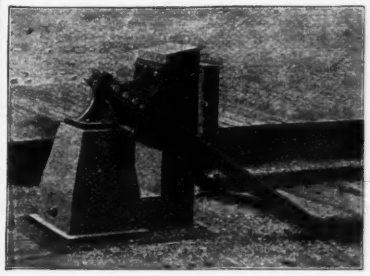

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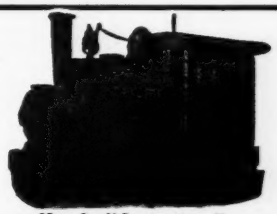
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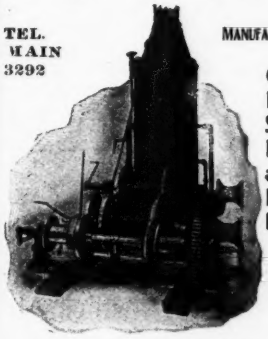

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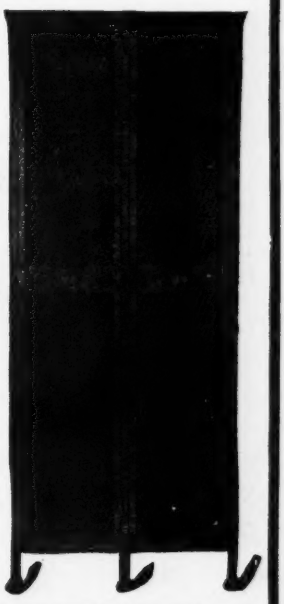

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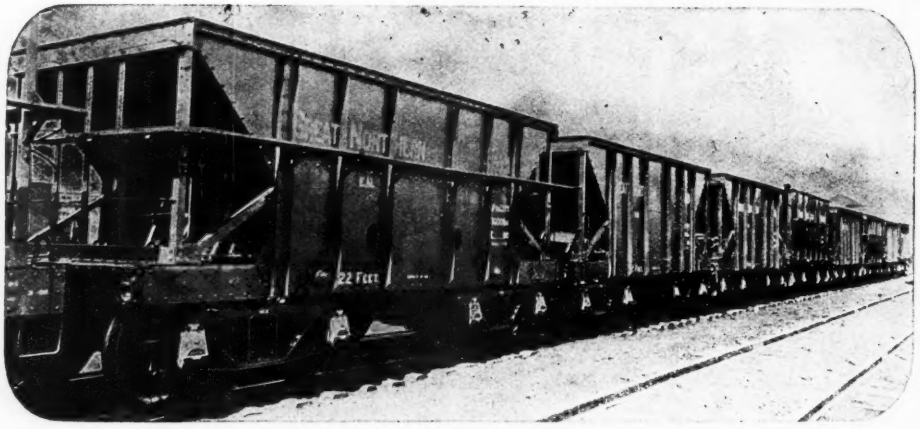

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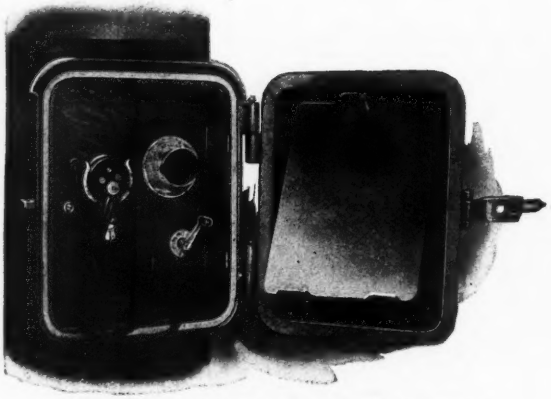

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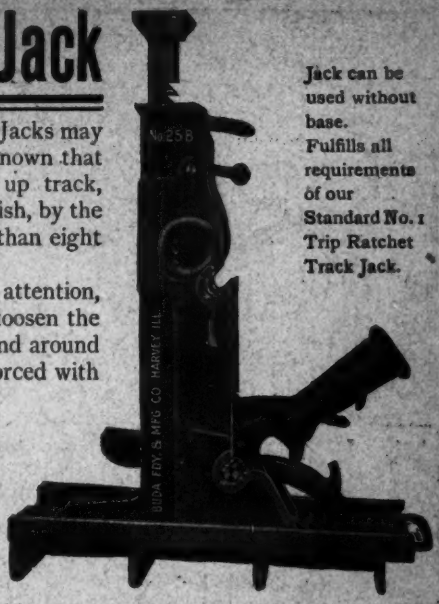
Where crossings, for instance, require attention, they are readily elevated just enough to loosen the ties—but not to allow cinders to fall in and around the ties—and then the crossing can be forced with ease the desired distance.

On small divisions and branch lines where track force is always too small to give proper attention to lining up, and during those seasons when the main line force is greatly reduced, these jacks are of great value; for a section foreman and one man can line up track as readily as they may tighten up nuts.



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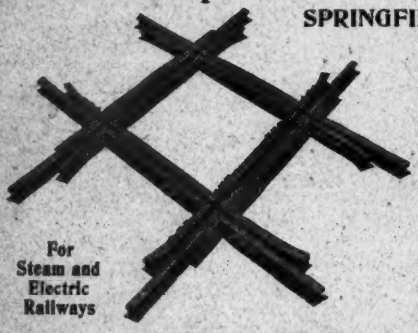

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